C A R I B B E A N E X A M I N A T I O N S C O U N C I L

REPORT ON CANDIDATES' WORK IN THE SECONDARY EDUCATION CERTIFICATE EXAMINATION

JUNE 2010

ELECTRICAL AND ELECTRONIC TECHNOLOGY TECHNICAL PROFICIENCY

GENERAL COMMENTS

The number of candidates who wrote the examination was 3,394. This represented an increase of about one per cent when compared with 2009. This increase was due to the fact that more schools entered for the subject which is becoming more popular in some countries.

Sixty-two per cent of candidates achieved Grade III and above. Candidates did well on the practical project of the internal assessment but displayed the need for improvement on the written project. Competencies tested in Paper 01 (Multiple Choice) and Paper 02 (Essay and Problem Questions) were Knowledge and Applications. Paper 02 also consisted of compulsory short-answer questions.

DETAILED COMMENTS

Paper 01 — Multiple Choice

Though candidates' performance on this paper was comparable with performance in 2009, there is still need for better and broader coverage of Modules 1 — 4 and 6 — 7 of the syllabus. Frequent practice for candidates in the use of the Multiple-Choice format is advised.

Paper 02 — Structured Essays

This paper comprised three sections: A, B and C. Section A comprised five compulsory short-answer questions, each worth eight marks. Section B comprised four questions. Candidates were required to answer three questions, each worth 20 marks. Section C comprised two questions, each worth 20 marks. Candidates were required to answer one question in this section.

Section A

Question 1

This question tested knowledge and application of transformers.

In Part (a), most candidates were able to name the two types of induced e.m.f.

In Part (b), most candidates stated iron losses (hysteresis loss and eddy current loss) as the two main losses.

In Part (c) candidates' responses were poor in stating Lenz's Law and Faraday's Law. It would be helpful for teachers to perform practical demonstrations for these principles.

Question 2

This question tested the sources of energy used to create steam in the steam turbines for commercial production of electricity. Most candidates answered this section correctly.

Part (b) tested candidates knowledge of the type of cables used for high voltage transmission. A number of candidates responded correctly.

Part (c) tested advantages of generating alternating voltages for transmission. Many candidates were able to recognize the use of the transformer for voltage transmission. Few candidates were able to connect the high voltage transmission to reduced losses and increase efficiency of transmission to reduced losses and increase efficiency of transmission.

Field trips to local electrical generation and distribution stations, emphasizing energy sources used commercially and the various considerations when choosing cables and voltages for transmission would be useful.

Question 3

This question tested candidates' ability to explain the function of the moving coil instruments and the moving iron instruments.

For Part (a), which asked candidates to state the characteristics of the moving iron instrument, candidates' responses did not show full knowledge of the instrument. This is an indication that candidates' exposure to these types of instruments is limited. Practical demonstrations in the use of such instruments would be useful.

Part (b) required candidates to name the types of scales used in instruments. Some candidates were able to state the types of scales but a number of them did not respond. Again practical work in this area would be beneficial.

Candidates did well in Part (c). Candidates drew diagrams to the effect that they knew how to connect the meters to measure the voltage across a component, or the current flowing through the component, but they did not show how to connect the multiplier or shunt resistances to change the function of the moving coil meter.

Question 4

This question tested candidates' knowledge and application of primary and secondary cells in electrical circuits. Candidates were asked to

(a) state the difference between a primary and secondary cell.

(b) list two methods used to determine the discharge status of a lead acid battery.

(c) give one advantage and one disadvantage of the lead acid battery.

The responses for Part (a) were quite good. However, incorrect responses were given for Parts (b) and (c). Candidates should have stated the use of the hydrometer and high discharge tester to determine the state of the secondary cells.

Question 5

Semi-conductors are the building block for all modern electronics such as the diode, transistor and integrated circuit (IC). This question was designed to test candidates' knowledge of the materials used in the manufacturing of semi-conductor devices, their ability to draw circuit diagrams showing the methods of biasing the PN junction diode and to give applications of a thyristor in an electrical circuit.

For Part (a), many candidates identified silicone and germanium as two of the materials used in the manufacture of semi-conductors. However, a large percentage of candidates did not name the materials properly. Candidates should be encouraged to research these topics as assignments with marks going towards their final terms mark.

Part (b) was done well. Most candidates were able to draw the circuits diagrams demonstrating how to forward and reverse bias the diodes.

For Part (c) many candidates were able to describe an application for a thyristor. However, most of these applications were general in nature and few candidates could identify specific circuits where thyristors can be used.

Candidates should be asked to build simple circuits using various semi-conductor devices. These should be encouraged to identify practical uses for their circuits.

Question 6

This question tested knowledge and application of Ohm's Law for a series/parallel circuit.

For Part (a), candidates' responses were good. They were able to state Ohm's Law in words and in the form of the formula.

For Parts (b), (c) and (d), candidates' responses were satisfactory.

For Parts (e) (i) — (iv), the analytical and computation parts were poorly done. Candidates were unable to correctly calculate the quantities in this section. It seems special attention needs to be paid to providing enough practice in problem-solving techniques in this area.

Question 7

This question examined the concept of the use of a shunt wound d.c. machine as a motor or a generator through the use of an application problem.

For Part (a), most candidates had difficulty recalling the generator equation, $E = V + I_a R_a$ motor equation, $E = V - I_a R_a$. As a result, most candidates demonstrated no knowledge of the working of the machines and motors. This section of the syllabus requires special attention. For Part (b), the use of the variable resistor in the motor starter circuit was not explained properly.

For Part (d), candidates were required to explain the purpose of the field resistor in controlling the speed of the motor. Most candidates obtained full marks for this section. The aspect of the syllabus tested by this question can be reinforced by simple practical exercises in the laboratory, an application worksheet or by performing laboratory exercises with a simulation software.

Question 8

This question tested candidates' knowledge of the operation of rectifier circuits.

Part (a), required candidates to state the peak inverse voltage that was applied to the diode, while the positive end of the diode faced a fully charged capacitor. The regulation of the system was not attempted.

Part (b), which asked candidates to explain the difference between half-wave and full-wave rectification, was well done, which means that the majority of candidates had knowledge of half-wave and full-wave rectification.

Part (c), was also done well.

Question 9

This question tested candidates' knowledge and application of logic gates.

In Part (a), candidates were asked to sketch the symbols for a NAND and OR gates. For Part (b), candidates were to construct truth tables of NAND and OR gates.

For Part (c), candidates were given a lamp circuit and asked to state the OPEN and CLOSED positions of the switches for the lamp to be ON and to name the logic gates which perform the same function as switches (i) A and B and (ii) C and D.

For Part (d), candidates were to name the logic gates which perform the same function as switches (i) A and B and (ii) C and D.

In Part (e), candidates were required to derive a Boolean expression for the logic circuit shown in the given figure.

Parts (a), (b), and (c) were answered well by most candidates. Not many candidates responded to Part (e). However, those who responded gave the correct answer and received some of the marks.

Question 10

With the majority of homes having electricity, most candidates should have been exposed to a variety of electrical devices in their home environment. This question was designed to test candidates' knowledge of the common electrical component symbols, their ability to explain the function of the earthing system and to suggest an alternative device for an earth electrode and identify electrical tests that can be carried out on a new electrical installation.

This question was poorly done. Candidates had difficulties in each section of this question.

Part (a) was not done well. Many candidates had little or no knowledge of the electrical circuit symbols. Candidates should be encouraged to use the correct electrical circuit symbol at all times. Simple electrical house plans can be used to help candidates identify fittings and other devices used in electrical installations. Candidates should be encouraged to write a material list for the installation.

For Part (b), some candidates were able to identify the function of individual components. Few candidates were able to explain how the components work to provide protection from electrical shock.

For Part (c), most candidates were unable to identify the components to replace the earth electrode in an electrical installation.

For Part (d), some candidates could identify electrical tests, most of them could not and very few could describe the tests.

As a project, students could be involved in wiring temporary installations such as a lamp and socket circuit. A breaker panel complete with earth conductor and earth electrodes should also form part of the project. Students could be given the opportunity to test the installation and research alternatives to using the earth electrode. This exercise could be marked as part of their term's work.

Question 11

This question tested knowledge and application of the computer.

For Part (a), candidates were able to list the output devices. In Part (b), candidates' responses suggested more of an application (Internet connection) than that of a function.

In Parts (c) and (d), candidates' responses were good. For Part (e), candidates were unable to explain the function of the operating system of a computer.

In Part (f) candidates' responses were good.

Overall, this question was well answered.