

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
CARIBBEAN SECONDARY EDUCATION CERTIFICATE[®] EXAMINATION**

MAY/JUNE 2014

**MECHANICAL ENGINEERING TECHNOLOGY
TECHNICAL PROFICIENCY EXAMINATION**

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GENERAL COMMENTS

The number of candidate entries has been consistent over the last 2 year with 2054 entered. The performance of candidates in this year's examination was consistent with that of last year with a very slight improvement in the number of candidates achieving acceptable grades from 70.79% in 2013 to 71.72% in 2014. Candidates continue to show difficulty in responding to questions requiring experience and knowledge gained from working with specialized equipment.

DETAILED COMMENTS

Paper 01 – Multiple Choice

This paper consisted of 60 multiple-choice questions, testing the profile dimensions of Knowledge (Profile 1), and Application (Profile 2). The mean score of 33.05 showed some improvement in candidates' performance on the paper over the previous 2 years.

DETAILED COMMENTS

Paper 02 – Essay/Structured Response Questions

Section A – Compulsory Question

Question 1

Candidates were given a figure showed a conceptual design for a low-cost treadmill. This design would use the angle of elevation of the platform to increase the load experienced by the user.

The given figure consisted of the following parts: a base, platform, and a handle.

The Specifications given were that:

- Part 1: The base, fabricated from steel, upon which the entire treadmill rests, is 3 m long and 2 m wide.
- Part 2: The platform, consists of two (2) drums, C and D, and a leather belt which rotates as the user walks/jogs on the treadmill at variable speeds. The platform is 2 m long and 1 m wide.
- Part 3: The handle is made from a 5 cm diameter pipe which is padded with sponge

As part of the low-cost feature it is required that all adjustments are to be made manually, that is by hand. In Part (a), candidates were required to produce a presentation that was neat, proportional and indicated clear details on sketches. Some candidates produced fairly neat sketches while others presented some that were difficult to understand. Candidates should try to present at least two views of the details they are trying to present. Candidates could also use notes to further explain how their design could work.

In Part (a), candidates were required to complete a design of the design for a low-cost treadmill, to meet the specifications given, using sketches to show the following:

- (i) A method of attaching the base to support the platform at Point A and Point B.
- (ii) A method which will allow the drum, C, to rotate about A so that the platform can be inclined up to a maximum of 30° along the axis X-X.
- (iii) The handle attached to the support at Point B.
- (iv) A method which will allow the platform to be inclined in 10° increments.
- (v) A method which will allow the handle to be adjusted about Point B and always remains vertical at any angle of inclination of the platform.

There were 2026 responses or 97 per cent of the candidates answered this question.

In general, candidates produced fairly accurate designs with neat sketches containing details which match the given specifications. Candidates presented very good responses to (b) (i) attaching the base to support the platform and (ii) method which will allow the drum, C, to rotate about A.

However, some candidates presented drawings which were untidy, lack detail information and which did not reflect the given specifications. Some designs were often difficult to understand.

Teachers are reminded to guide students to present at least two views of the details they are presenting. Students should also be encouraged to make use of notes to explain their designs.

Section B

Candidates were required to answer any three questions of five from this section. Each question was worth 20 marks.

Question 2

The question shows a figure of a test plug to be knurled and tapered on the centre lathe.

The objective of this question was to test candidates' knowledge of:

- types of tools to be used in the production of the test plug
- steps of procedure, for producing the knurled surface
- precautions that should be taken to ensure the best knurl was produced
- using a sketch to show the work and cutting tool set-up to produce the taper
- methods of producing the taper
- safety precautions that should be observed while working on the centre lathe

This was a fairly popular question as it was attempted by a large number of the candidates. There were 1504 responses or 72 per cent of the candidates answered this question.

In many cases, candidates were unable to name the types of tools to be used in the production of the test plug or to list the steps of procedure to produce the knurled surface.

Candidates had difficulty in using a sketch to show the work and cutting tool set-up to produce the taper. There were no accompanying notes to indicate the different parts of the sketch.

Question 3

The question shows a figure of a component with a T-slot, similar to that on the milling machine table, which is to be produced on the milling machine.

The objective of this question was to test candidates' knowledge of:

- The cutting tools that could be used to produce the T-slot
- Steps of procedure, for producing the T-slot
- The factors that could negatively affect the life of a cutting tool
- The primary purpose of the dividing head that is used in gear-cutting operations on the milling machine
- Calculating simple indexing using the Browne and Sharpe plates
- Safety precautions that should be observed when operating the milling machine.

This question was fairly popular. There were 736 responses or 35 per cent of the candidates answered this question.

In many cases, candidates were unable to name the types of tools to be used in the production of the T-slot, or to list steps of procedure to produce the T-slot, in many instances, the tools given were ordinary bench

tools. Similarly, the use of bench tools, files, hacksaws, was indicated in the steps of procedure to produce the T-slot.

Although the safety precautions required were to be related to the operating the milling machine many of the responses given were general safety precautions such as, the use of gloves or wearing of safety goggles.

Question 4

The question showing a figure of the hub of a wheel puller which is to be produced from a 20 mm thick disc, cut off from a 100 mm cylindrical bar.

The objective of this question was to test the candidates' knowledge of:

- The steps of procedure required for marking out the hub.
- Tools to be used to complete marking out of the mechanism.
- The precautions that should be observed while marking out the wheel puller.
- The steps of procedure, in sequence, to be used for cutting out and finishing the slots by chain drilling.
- Tools to be used for the cutting out and finishing the slots.
- Safety precautions that should be observed when cutting out the slots.

This was a popular question. There were 1121 responses or 54 per cent of the candidates answered this question.

The candidate's responses to the steps of procedure required for marking out the hub were very general and unclear.

In many cases, candidates were unable to outline the steps of procedure for cutting and finishing the slots by chain drilling of the wheel puller. Although the steps outlined were correct, in some cases, they were not in the correct order.

Question 5

The question presented a figure showing a pictorial view of an oil pan, 50 mm deep × 200 mm wide × 300 mm long. The oil pan is to be made from 24-gauge galvanized sheet in the work shop. An additional 10 mm must be included for making the edges safe.

The objective of this question was to test candidates' knowledge of:

- Calculating the minimum length and width of material required for making the oil pan.
- Methods of making the corners of the oil pan.
- The steps of procedure for making the oil pan.
- The steps of procedure for making safe edges.
- Methods of making the safe edge for the oil pan.
- Tools that will be necessary for completing the oil pan.
- Safety precautions that should be observed when working with sheet metal.

This was a popular question as it was attempted by a large number of the candidates. There were 1232 responses or 59 per cent of the candidates answered this question.

Candidates had difficulty in calculating the minimum length and width of material required for making the oil pan, in many cases, the finished dimensions on the figure were given.

In many cases, candidates were unable to outline the steps of procedure for making the oil pan and for making safe edges.

Many candidates also confused 'methods' of making the safe edge with 'procedures' for making the safe edges.

Question 6

The question presented a figure showing two 50 mm diameter lengths of pipe that are to be joined together using bolts, nuts and washers, to extend the length of the pipes to form a flag pole.

The objective of this question was to test candidates' knowledge of:

- The steps of procedure for marking out and drilling the pipes.
- Types of bolts that could be used for fastening the pipes.
- Showing, with the aid of a sketch, how the pipe can be held in position for drilling.
- Showing, with the aid of a sketches, show the differences in shape of the cutting edges of different types of cold chisels.
- The steps of procedure for grinding the point of a flat cold chisel.
- Safety precautions that should be observed when drilling the pipes.

This was another popular question as it was attempted by a large number of the candidates. There were 1256 responses or 60 per cent of the candidates answered this question.

Candidates had difficulties in using a sketch to show how the pipe can be held in position for drilling. They also had difficulties in showing differences in shape of the cutting edges of different types of cold chisels. There were no accompanying notes to indicate the different parts of the sketch.

Section C

Candidates were required to answer one question from this section. Each question was worth 20 marks.

Question 7

The question presented a figure showing two pieces of mild steel plates that are to be welded together to form a 'T' component; using either the oxy-acetylene or arc welding process.

The objective of this question was to test candidates' knowledge of:

- Pieces of equipment necessary to carry out the process chosen.
- The steps of procedure that is necessary to carry out the operation.
- Protective clothing that must be used to carry out the operation.
- With the aid of a sketch, show the sequence of the weld bead on both sides of the 'T' using three passes of the weld bead to ensure a strong weld.
- Safety precautions that should be taken while carrying out the welding process.
- Defects that may occur as a result of improper welding.

This was a fairly popular question as it was attempted by a large number of the candidates. There were 1298 responses or 62 per cent of the candidates answered this question.

In general, the candidates were able to list the equipment necessary to carry out the process for either the oxy-acetylene or arc welding process.

Candidates had difficulties in using sketches to show the sequence of the weld bead on both sides of the 'T' using three passes of the weld bead to ensure a strong weld.

Question 8

The question presented a figure showing a length of mild steel bar which is to be flattened and drilled at one end in order to attach it to a bolt.

The objective of this question was to test candidates' knowledge of:

- The process to be used for flattening the rod.
- The steps of procedure, in sequence, with the aid of sketches, required for flattening the rod so that the required size of hole can be drilled.
- Tools to be used in the process.
- Safety precautions that should be observed during the process.
- Situations observed during foundry work, to indicate the result of each situation and a remedy for each of the situation.

This was not a popular question. There were 91 responses or 4.4 per cent of the candidates answered this question.

Candidate's responses indicated 'procedure' rather than 'process.'

Again, candidates encountered difficulties in listing the steps of procedures and using clearly labelled and well-presented sketches in their responses.

Question 9

The question presented a table showing the design of a maintenance chart for machines in the workshop, mechanisms for transferring motion; types of lubrication for any of the mechanisms shown; form in which types of plastic listed are produced and indicate an example of an article which is made from the plastic.

The objective of this question was to test candidates' knowledge of:

- Making an entry to demonstrate understanding how the table is used.
- Different mechanisms for transferring motion, with the aid of sketches.
- Types of lubrication which are necessary for any of the mechanisms shown
- Safety precautions that should be observed when servicing a machine in the workshop.
- Identifying the form in which types of plastic are produced and indicate an example of an article which is made from the plastic.

This was not a popular question. There were 199 responses or 9.5 per cent of the candidates answered this question.

Many of the candidates were able to demonstrate understanding how the table is used. Candidates were also able to identify the form in which types of plastic are produced and provided an example of an article which is made from the plastic.

However, candidates had difficulties in using clear and well-presented sketches in their responses to indicate the different mechanisms for transferring motion.

Recommendations to Teachers

The following suggestions are offered to teachers in the effort to assist the students to improve their performance in the examination.

- Teachers should guide students to make use of additional notes to support the explanation in regard to how their designs can work.

- Teachers should guide students to list steps of procedures in sequential order. This could be done by requiring students to write the steps of procedures in sequential order before they begin to carry out the actual procedure.
- Teachers should guide students in regard to correct safety precautions. Many of the responses in regard to safety precautions are generally given as using gloves, wearing goggles, although the question require application to specific situations, operations or machines.
- Teachers are encouraged to develop a time plan for the teaching of the content of the syllabus which they can then use as a guide to assist them in ensuring that students' successfully complete the syllabus in preparation for the examination. Teacher's time plan may reflect, in their unit and lesson plans, the breakdown in terms of the area(s) of the syllabus that is to be covered within a week, month, term or year.
- Teacher should emphasize to students the value of neatness in the presentation of their work as this is that is likely to improved accuracy in the students' work.
- Teachers can work in combination with the Information Communication facility and teachers at their school or community level to assist students to make use of the Internet to find and use simulations and animations.
- Students' should be presented with continuous and regular activities that will provide them with opportunities to interpret engineering drawings and sketches to assist their capability and enhance learning.
- Students' should be provided with different of opportunities to create design drawings that are likely to help them recognize their strengths, and identify and work through their weakness. These exercises may be done as individual tasks or as small group engagements where students can benefit from the critique and suggestions of their peers.
- Students should be presented with opportunities to visit workshops/workplaces where mechanical engineering skills are practised. In this way students could get first hand experiences of how what they are learning in the classroom can be put to work in reality. Also, this kind of activity would give students an opportunity to interface with expertise in the field, which can serve as additional motivation for them.
- In cases where, the institution does not have the necessary equipment and facilities to effectively deliver the programme as outlined in the syllabus, teachers might find it useful to explore the possibility of having students visit other schools/centers as a way of helping them to become familiar with the operations of these equipment.
- Also, many manufacturers' websites have simulations, animations and other resource material that can enhance students learning experiences. These resource material and learning experiences will require careful selection, monitoring and supervision, since not all items placed on the Internet are factual. Encourage use of mobile devices and tablets to access these sites.