CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE SECONDARY EDUCATION CERTIFICATE EXAMINATION MAY/JUNE 2008

MECHANICAL ENGINEERING TECHNOLOGY

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TECHNICAL PROFICIENCY EXAMINATION
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GENERAL COMMENTS

1 496 candidates were entered for the 2008 examination compared with 1 475 for the 2007 examination. Of the 1 496 candidates entered for the examination 82.34% of the candidates earned Grade III and above. This represented a 1.8% increase in performance over that of 2007.

Candidates continue to do well on the practical project for the Internal Assessment component (SBA) but there is still the need for improvement on the written component of the (SBA). The candidates performed poorly on compulsory Question 1 on Paper 02, thus emphasizing the need for urgent attention to be paid to the question which requires candidates to demonstrate knowledge and application of the work done in module B8 of the Unit.

DETAILED COMMENTS

Paper 01 – Multiple Choice

This paper consisted of 60 items testing the theoretical aspects of the Unit. There were 30 items testing the Knowledge profile and 30 items on the Application profile. The topics that most candidates found difficult were:

1. How to prepare work for turning between centres
2. The engineering use of grey cast iron
3. Identification of engineering fasteners
4. Mechanisms used to connect mechanical devices
5. The use of the various angles on lathe cutting tools
6. Properties of ferrous metals
7. Identification of thermosetting plastic material

PAPER 02 – Essay/Structured Response Questions

Section A

Question 1

Candidates were required to complete the design of a Link Mechanism. A wheel "A" which is free to rotate through 360 degrees was to be connected by a link to a block "B". As the wheel "A" rotates it forces the block "B" to slide to and fro in a guide "G". A motor which is secured to a plate is used to transmit motion to the wheel.

The major design considerations were:

(a) Showing the Link in position. This could have been done by showing a bar stretching from the edge of the wheel "A" to the center of the block "B". Most of the candidates were able to show a link, however some used the bracket that was to support the mechanism as the link. This solution would render the mechanism inoperable as the block would be fixed to the bracket and could not slide to and fro as required. Others used a belt which could not be used for the process.

(b) The link connected to the wheel "A". This could have been done by using a nut and bolt along with a lock washer to prevent the nut from backing off while the wheel turns. Some of the candidates used a nut and bolt for the connection, however no washers etc were used to assist in securing the nut.

(c) The link connected to block "B". This could have been done by using a bolt in the block with nut and washer to lock in place and allow it to rotate.

(d) A method of transmitting motion from the motor to the shaft. This could have been done by using pulleys and a vee belt which would allow the motor and mechanism to remain in place. However some candidates moved the motor from the given location and used a coupling to connect the motor spindle to the shaft. This was accepted as a possible solution as it was not specified in the drawing that the components should remain in the given position.

(e) The motor secured to the plate. This could have been done by using nuts and bolts. Most candidates used nuts and bolts for the solution, however some just simply said use screws. These would work themselves loose from the vibration of the motor, so some lock washers would have to be used to secure the base.

(f) A provision for lubricating the shaft in the bracket. This could have been done with a grease nipple, or oil cup attached to the unit. Some candidates simply drilled a hole for the lubrication which by itself would not keep contaminants out of the area.

This question which is compulsory continues to be a problem for a large number of the candidates. The ability to interpret the given drawing and provide plausible solutions using clear sketches seems to be beyond a number of these candidates. While some candidates are able to score close to full marks on the question others did not attempt it, or just reproduced the given drawing without attempting a solution to the question. One of the problems that the candidates encountered was the concept of a link, crank mechanism and how the movement was achieved. They connected the link to the centre of the wheel "A", this connection would not allow wheel "A" to move the link to effect the sliding of the block "B".

Section B

Question 2

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

(a) (i) The procedure for shearing a piece of thick sheet metal using a flat chisel

(ii) Tools besides the flat chisel used in the process

(iii) Safety precautions that should be employed when shearing

(b) (i) An explanation of the term "pinning"

(ii) How pins are removed

(c) (i) The steps of procedure for cutting an M6 X 1.0 external thread

(ii) The type of cutting fluid that should be used when threading steel

(iii) The meaning of M6 X 1.0

This was a fairly popular question as it was attempted by 74% of the candidates.

Aspects of the question that were well done included the following:

- Safety precautions that should be employed when shearing

Aspects of the question that were not well done included the following:

- Steps of procedure for shearing the sheet metal using a flat chisel
- Explanation of the term "pinning"
- How to remove "pins"
- Steps of procedure for cutting an external thread
- The type of cutting fluid that should be used when threading steel
- The meaning of M6 X 1.0

Most of the candidates were not able to provide a reasonable sketch and list the steps of procedure for shearing the sheet metal.

Question 3

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

(a) (i) The steps of procedure for marking out a template on sheet metal.

(ii) Naming the tools to be used in the marking out process.

(b) (i) The operations involved in cutting out a slot in sheet metal.

(ii) The tools to be used in the cutting out process.

(c) (i) Precautions that should be taken while marking out to ensure accuracy is Maintained.

(ii) Safety precautions that should be observed while cutting sheet metal with bench work tools.

(d) The size of the grinding angle of a centre punch.

This was a very popular question as it was attempted by 89% of the candidates.

Aspects of the question that were well done included the following:

- Steps of procedure for marking out the template
- The tools used in the process
- The cutting out of the slot
- Safety precautions to be observed during the processes

Aspects of the question that were not well done included the following:

- The "mixing up" of marking out procedures with cutting out procedures by some candidates
- Naming the grinding angle of the centre punch

Question 4

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

(a) The name of the parts in a setup for turning between centres on the lathe

(b) The name of the various angles on a lathe tool bit

(c) (i) The steps of procedure for cutting an external thread on the lathe

(ii) The steps of procedure for producing a knurled surface on the lathe

(d) Precautions that should be observed while working on the lathe

This was a fairly popular question as it was attempted by 63% of the candidates.

Aspects of the question that were well done included the following:

- Steps of procedure required to produce the knurled section of the component
- Safety precautions to be observed while working on the lathe

Aspects of the question that were not well done included the following:

- Most candidates were not able to name the parts of components for turning between centres
- Naming lathe tool angles.

Question 5

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

(a) The allowances to be made in sheet metal for producing

(i) wired edge
(ii) lap bottom
(iii) groove seam

(b) Calculating the length or wire required to produce a wired edge on a component

(c) The steps of procedure for producing a wired edge

(d) The steps of procedure for soldering the bottom of a cylindrical component to its side

(e) Safety precautions that should be observed when working with sheet metal

This was not a popular question as it was attempted by only 19% of the candidates. The only aspect of the question that was well done had to do with stating safety precautions to be observed while working with sheet metal.

The remainder of the question was poorly done.

- The sketching was poor and some who produced a sketch did not indicate the allowances requested.
- Most of the candidates were not able to calculate the length of the wire required to produce the wired edge. They also found it difficult to list the steps of procedure required to produce it.
- A few of the candidates were able to list the steps of procedure to sweat solder the prepared bottom to the side, but most of those who attempted the question simply said 'solder bottom with solder iron'.

Question 6

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

(a) (i) Steps of procedure for assembling metal plates using counter sunk screws.

(ii) Tools to be used in the assembling process.

(b) (i) Steps of procedure for assembling components with countersunk head rivets.

(ii) Tools to be used in the process.

(c) Precautions that should be observed while producing the assemblies

This was a fairly popular question as it was attempted by 47% of the candidates.

Aspects of the question that were well done included the following:

- Safety precautions that should be observed while producing the assemblies
- Tools to be used for countersunk assembly

Aspects of the question that were not well done included the following:

- Using sketches to assist in listing the sequence of operations for producing the assembly using the countersunk screws. Some candidates used a 6mm drill to drill the hole for the M6 tap.
- Most candidates attempted to use a pop rivet gun to complete the riveted assembly, rather than solid countersunk head rivets.

Question 7

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

(a) (i) The preparation made to 15mm thick plates to weld them together using the electric arc welding process

(ii) How the joint cavity is built up during the welding process

(b) The name of the component parts of a shielded electrode and the base metal being welded

(c) Ways in which sticking of the electrode can be avoided in the arc welding process

(d) Factors that contribute to proper penetration in the arc welding process

(e) Safety precautions that should be observed while arc welding

This was a fairly popular question as it was attempted by 44% of the candidates.

Aspects of the question that were well done include the following:

- Ways in which sticking of the electrode could be avoided while striking the arc
- Factors that contributed to proper penetration in a weld
- Safety precautions that should be observed while welding

Aspects of the question that were not well done included the following:

- Sketches indicating the preparation made to accommodate the weld
- Sketches indicating how the joint cavity was to be built up with the weld metal
- Sketch indicating the cross-section of the shielded electrode and the welded component and naming the parts

Question 8

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

(a) The process of carrying out case hardening, using pack carburizing

(b) Stating the difference between hardening and case hardening

(c) Stating the use of various forging tools

(d) Explaining why a component that is forged is stronger than one that is machined

This was the most unpopular question as it was attempted by only 6% of the candidates. It would appear as if this section of the syllabus was not covered adequately by teachers in the various schools. This question was very poorly done by the candidates that attempted it. Aspects of the question that were not well done included the following:

- The process of carrying out case hardening, using pack carburizing. Here a few of the candidates attempted some form of case hardening by heating the component with a torch and dipping it in a case hardening compound. This would case harden the component but the question specifically asked for pack carburizing.
- Stating the difference between hardening and case hardening.
- Stating the use of various forging tools.
- Giving a plausible explanation of why a component that is forged is stronger than one that is machined.

Question 9

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

(a) The different forms of maintenance

(b) When it is desirable to use different forms of maintenance

(c) Using sketches to indicate the type of gearing to use in different situations

(d) Naming the categories into which lubricants fall

(e) The procedures used to lubricate different components

This was not a popular question as it was attempted by only 38% of the candidates.

Aspects of the question that were well done included the following:

- Explaining the different forms of maintenance
- Giving examples of when it was desirable to use the different forms of maintenance

Aspects of the question that were not well done included the following:

- Sketching to show the applications of types of gearing
- Naming the different categories for lubricants
- Explaining the procedures for lubricating mechanical components

Notes to Teachers

1. The written report is an individual assignment and should be treated as such by students.

2. More attention needs to be paid to Unit B8 of the syllabus which addresses Question 1 on Paper 02, this could be achieved by addressing the following suggestions:

    - Students should be given exercises in designing which involve sketching, making models.
    - Students can be taken on field trips to various industries where aspects of mechanical devices/mechanisms not seen in the school workshop can be seen.
    - Teachers should assist students in examining and reporting on mechanisms relating to machines in the school's workshop.

    This process might involve the taking down of machine guards to have a first-hand look at mechanism. It is important to remember however that machines should be shut down before these operations can be carried out.

3. Where schools do not have the machines required for the programme, students can be taken to centers where these are available and have suitable persons giving demonstrations of the uses of these machines.

4. Students should be encouraged to provide sketches to assist with their explanations in answering the various questions.