

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATIONS**

**JUNE 2006**

**MECHANICAL ENGINEERING TECHNOLOGY**

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**MECHANICAL ENGINEERING TECHNOLOGY**  
**TECHNICAL PROFICIENCY EXAMINATIONS**

**JUNE 2006**

**GENERAL COMMENTS**

Seventeen hundred and eighty seven (1787) candidates were entered in 2005, while the total entry for 2006 was 1777. Approximately 80% of the candidates entered for the examination earned Grade III and above; this performance was similar to that of 2005.

Candidates continue to do well on the practical component of the SBA but need to improve their performance on the written component. The performance on both Papers 01 and 02 needs to be improved significantly. Question 01 on Paper 02 continues to be of concern. Candidates do not demonstrate the knowledge and application needed to satisfy Module B8 of the unit.

**DETAILED COMMENTS**

**Paper 01 – Multiple Choice**

The paper consists 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. The meaning of the term parting off
2. Indexing
3. Causes for grinding wheel to wear away rapidly
4. Point angle of chisel for cutting aluminium
5. How to layout a large circle for drilling
6. Hard soldering
7. Reading the micrometer
8. Calculating the tolerance of a given dimension
9. Pattern development
10. Machine used for shaping cylinders from sheet metal
11. Forging
12. Tempering colours for various hand tools
13. Welding safety
14. Heat treatment process
15. Production of aluminium
16. Types of thermosetting plastics

**PAPER 02 – Essay/Structured Response Questions**

Paper 02 (2 \_ hours) A free response paper divided into three sections. Each question received equal weighting for the profile dimensions, Knowledge and Application.

Section A – One compulsory design question based on Module B8 of the Unit worth 40 marks. Candidates were required to spend approximately 50 minutes on this question.

Section B – Five questions based on Modules B2 to B5 of the Unit. Candidates were required to answer three questions. Each question worth 20 marks.

Section C – Three questions based on Modules B6, B7, and B8 of the Unit. Candidates were required to answer one question. Each question was worth 20 marks.

## **Section A**

### Question 1

Candidates were required to complete the design for a hoist and hook unit. Two views of the incomplete unit were provided and candidates were required to design a housing to house a set of rollers “D” and a shaft “B”. They were also required to indicate a method of attaching a hook “C” to the shaft “B”.

The major design considerations were :

- (i) The rollers “D” attached and retained to the housing and free to rotate about their axes.

Those that attempted the question indicated the rollers in place as shown on the diagram but most did not indicate how the rollers were attached. As in previous years, the ability to sketch seemed to be a major problem as what was represented as solutions for the various requirements was difficult to interpret. Some candidates did not represent nuts and bolts very well, and in some instances only one view was shown which made it difficult to decide what was happening on the opposite side of the unit.

- (ii) The shaft B, in position in the housing and supported by two bronze bushings inserted into the housing.

Most candidates attached the shaft to the housing without the bushings. Some indicated bushings by pointing arrows where the bushings were supposed to be but they were not represented in the sketch. Some candidates did not seem to know the difference between a bushing and an antifriction bearing.

- (iii) The shaft “B” free to rotate about its axis to facilitate the swinging movement of the hook “C” as indicated by arrow E.

The drawings produced were not very clear in most cases it was therefore difficult to determine if the shaft could in fact rotate.

- (iv) A means of retaining the shaft “B” in the housing in order to prevent axial movement

This aspect of the question was fairly well done by those that attempted it. Pins and washers were used in some instances to secure the shaft in place.

- (v) The hook “C” attached to the shaft so that it could swivel within the shaft as indicated by the arrows at “F”

Most of the candidates that attempted the question gave reasonable solutions to this aspect of the question. They allowed the hook to pass through a hole in the shaft in most instances. Some candidates however attempted to use bearings etc. to hold the hook as swivelling in their opinion had to employ the use of bearings.

- (vi) The hook being retained in the shaft.

This aspect of the question was fairly well done. Here again pins and washers were used to secure the hook.

- (vii) The unit being able to move along the length of the beam “A” in both directions as indicated by the arrows “G” but restricted from any side movement greater than 2mm.

The sketches used to indicate this aspect of the solution were not very clear in most instances and it was therefore difficult to determine if the unit could in fact move along the beam.

In general there seemed to have been some improvement in the responses for this particular question even though a number of candidates did not attempt the question. Some candidates attempted to make accurate assembly drawings of the unit and in some instances only reproduced the given sketches without attempting the solutions to the problem. It is preferred if candidates produce neat representational sketches rather than attempt to draw using Tee squares etc. as this could be quite time consuming. The solution to the problem is of primary concern as most marks are awarded for that aspect of the question. It is therefore possible for sketches with the solution to be awarded more marks than neat drawings reproducing the diagrams given for the exercise, without the desired solutions to the problem.

## **Section B**

### Question 2

The objective of this question was to test the candidates’ knowledge and understanding of the following:

- (a)
  - (i) The steps of procedure for machining a component on the centre lathe.
  - (ii) Sketching and naming tools to be used in the process.
- (b) How the carriage of the lathe is driven when it is engaged for screw cutting.
- (c) Ways in which work may be secured and driven on the centre lathe.
- (d) Safety precautions that should be observed when using the centre lathe.

This was a fairly popular question attempted by 83% of the candidates. This question was not handled very well by the candidates even though it is felt that most if not all institutions have at least one lathe in their workshop.

Most of the candidates that attempted the question did not outline the steps of procedure in a numerical format. They continue to write “essays” on the various steps and do not include measurements to indicate the areas of the component being referred to at each stage of the process.

On the whole it appeared as if candidates did not have enough experience using the lathe or with the various lathe tools used on the machine. Most of the candidates were not familiar with how the carriage moved during a threading operation.

The age old problem involving the difference between personal safety and safety precautions with respect to machines still persist, and it is felt that candidates need to know the difference.

### Question 3

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

- (a) (i) The steps of procedure for marking out a template.
- (a) (ii) The list of tools and equipment necessary for the marking out process.
- (b) (i) The steps of procedure for cutting out of a slot in sheet metal.
- (b) (ii) The tool to be used in the process.
- (c) (i) Safety precautions that should be observed while using marking out tools.
- (c) (ii) Safety precautions to be observed while cutting out the slot in the sheet metal.

This was a very popular question as 95.5% of the candidates attempted it. The question was fairly well done. Some candidates however were still not able to differentiate between general and personal safety. Candidates are still not writing the various steps of procedure in point form and this makes it difficult at times to search a long essay to find a few steps.

The steps for marking out the template would have included the following:-

- Mark all horizontal lines
- Scribe all vertical lines
- Locate and mark radii
- Mark angles
- Outline template

The sequence of the operations for cutting out the slot "A" in part (b) of the question would have included the following:-

- Prick punch
- Centre punch
- Chain drill
- Chisel/hacksaw
- File

### Question 4

The objective of this question was to test the candidates knowledge and understanding of the following:

- (a) (i) Steps of procedure for machining a component on a horizontal milling machine.
- (a) (ii) Sketching and naming a cutter that could be used to produce a rectangular slot.
- (b) (i) Stating the formula for calculating the rpm of a cutter
- (b) (ii) Calculating the revolution per minute required for a particular cutter.
- (c) Listing advantages and disadvantages of conventional (up-cut) method of milling.
- (d) Stating safety precautions to be observed when using the milling machine.

This was not a very popular question as only 33.9% of the candidates attempted it. Many of the candidates chose other operations rather than the milling machine to produce the slots, these included chisels, hacksaw and files. Some candidates did not know the names of cutters that could be used to produce the slots, or the advantages and disadvantages of conventional milling. On the whole most candidates did not seem to know a lot about milling in general even though they attempted the question. Part (b) of the question dealing with the calculation of rpm as well as part (d) dealing with safety precautions were fairly well done.

#### Question 5

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

- (a) Procedure for filing an area flat and smooth with 90 degrees corners
- (b)
  - (i) Stating the various classes of files
  - (ii) Stating the main differences between the various classes of files.
- (c)
  - (i) Problems that may arise when hack-sawing copper tubing.
  - (ii) How to overcome the problems that might arise while hack-sawing the copper tubing.
- (d) Stating safety precautions that should be observed when using the hacksaw.

This was a very popular question as 78.34% of the candidates attempted it.

Most of the candidates that attempted the question did not state clearly the procedures for completing the job effectively. The sketches indicating the procedure were not well done either and only a few candidates mentioned the use of a safe edge file to protect the corners.

#### Question 6

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

- (a) The steps of procedure required to produce a wired edge.
- (b) Making a dimensional sketch of the material to produce a component.
- (c) The steps of procedure for riveting two components together.
- (d) Listing safety precautions that should be observed when working with sheet metal.

This was not a very popular question as it attempted by only 20.21% of the candidates.

The question was poorly done by most of those who attempted it. It appeared as if most of the candidates did not understand the development involved. There appeared to be weaknesses in understanding the drawings given on the examination paper. This could be indicating that candidates lack the required exposure in technical drawing. In part (c) of the question most candidates used a rivet gun and pop rivets instead of the required snap head rivets to join the components.

Question 7

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

**EITHER**

- (a) The steps of procedure for using electric arc welding to join two pieces of mild steel.
- (b) The completion of a table indicating cause and remedy for the following problems:
  - (i) Oxidation of surface
  - (ii) Sticking of electrode
  - (iii) Excess metal (wide bead)
  - (iv) Lack of fusion
  - (v) Lack of penetration
- (c) Stating one factor that influences choice of the size of the electrode in electric arc welding.
- (d) Stating safety precautions to be observed during the arc welding process.

**OR**

- (e) The completion of a table by indicating the cause and corresponding remedy to the following oxy-acetylene welding defects.
  - (i) Distortion
  - (ii) Oxidation
  - (iii) Blow holes
  - (iv) Lack of fusion
  - (v) Lack of penetration
- (f) The use of sketches to show the relative position of the nozzle, rod and weld during the leftward (forehand) oxy-acetylene welding process.
- (g) Explaining with the aid of labelled sketches the three types of flames in relation to the gases used in the oxy-acetylene welding process.

This was a fairly popular question attempted by 47.26% of the candidates. Most of the candidates did not differentiate between electric arc, and oxyacetylene welding. The responses were all mixed up as they attempted to use electric arc methods to solve problems relating to oxyacetylene welding. Most of those that made sketches of the oxy-acetylene flames were not sure of the composition or the characteristics of the flames.

### Question 8

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

- (a) The development of a split pattern to produce a component.
- (b) Using labelled sketches to list the steps of procedure for preparing a mould ready for pouring.
- (c) Stating reasons for the following defects:
  - (i) Blow holes
  - (ii) Sand inclusion
- (d) Naming foundry tools used in the process of preparing a mould.

This was not a popular question as it was attempted by only 6.7% of the candidates. Most of the candidates that attempted the question chose to use a solid pattern instead of a split pattern as is required for the job.

Other aspects of the question that were not well done included the following:

- Steps of procedure for preparing the mould
- Reasons for the occurrence of the defects mentioned

Many of the candidates that attempted the question were able to name foundry tools used in the preparation of a mould.

### Question 9

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

- (a) Using sketches to illustrate the following systems of gearing:
  - (i) Rack and pinion
  - (ii) Worm and wheel
  - (iii) Spur
- (b) Giving applications of the various gearing systems used in part (a) of the question.
- (c) Listing functions of a typical preventative maintenance system.
- (d) Indicating the parts and characteristics of a drill press motor and spindle pulleys fitted with a belt.
- (e) Highlighting instances where a belt drive is more advantageous than a gear drive system.

This was not a very popular question as it was attempted by only 35.56% of the candidates.

Those that attempted the question made a fair effort at part (a) of the question. However most of them could not provide the desired application for the various gearing systems.

Most of the candidates that attempted the question were able to list functions of a typical preventative maintenance system and give reasons for them being important to the proper functioning of machines.

### **School-Based Assessment (SBA)**

School-Based Assessment (SBA) is intended to be useful to teachers and students, and maybe used as either or a diagnostic, formative and summative assessment tool. Candidates can present their BEST efforts once the suggested time-frame is followed by teachers. This format of the (SBA) requires both practical and written projects and should be taken seriously if candidates are to develop the intended competencies.

The overall performance on the SBA continues to be much better than that of the other two papers for the examination. However, there is room for improvement in the written component of the assignment. It should be noted that the written assignment is an individual project therefore; reproduction in part or whole of one candidates work by another is considered plagiarism. Candidates and teachers need to approach the written component of the SBA with greater planning and analysis of what is required if the aims of the common modules are to be realized.

#### Notes to Teachers

1. Candidates need to improve their skills at sketching which is very important in answering questions on paper 02 of this examination. They should therefore be encouraged to sketch and should be given exercises that will allow them to develop the required skills.
2. **All** candidates taking the examination should have technical drawing as a core subject. The school's programme should make it compulsory for them.
3. Candidates should be encouraged to sketch the solution to the design question (1) as a lot of time is spent by some trying to produce accurate drawings of the given views without the solutions.
4. More time should be spent addressing the issue of designing as the question on design is worth 33% of the marks on Paper 02 and some candidates do not attempt the question even though it is compulsory.
5. Mechanisms used to convey movement in machines such as chain drives, gear drives and belt drives should be introduced regularly to students. This process might involve taking down machine guards.

**NB.** Machines must be shut down before these operations are carried out.

6. Students should be taught how to differentiate between page number and question number as a large percentage of students continue to write page number or the number of the figure assigned to a question as the number for the question.