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 MAY/JUNE 2009

## MECHANICAL ENGINEERING TECHNOLOGY

**MECHANICAL ENGINEERING TECHNOLOGY**
**TECHNICAL PROFICIENCY EXAMINATION**
**MAY/JUNE 2009**

## GENERAL COMMENTS

Candidates again performedwell on the practical component of Paper 03, the School-Based Assessment.There is still the need for improvement on the written component of this paper. The candidates performed poorly on Question 1,the compulsory and only question in Section A of Paper 02. This emphasizes the need for urgent attention to be paid to elements of design,a requirement of module B8 of the Unit.

## DETAILED COMMENTS

### Paper 01 – Multiple-Choice Questions

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. Heat treatment terms
2. The difference between cutting speed and feed on the lathe
3. The unit for feed on the lathe
4. Identification of engineering fasteners
5. Mechanisms used to connect mechanical devices
6. Processes involved in forging
7. Properties of non-ferrous metals

### Paper 02 – Essay/Structured Response Questions

**Section A**

Question 1

Candidates were required to complete the design of a pulley adjuster that was to be used to adjust the tension of the belt in a mechanism. The arrangement consisted of a mild steel shaft (Diameter.15mm) which was to run freely through the pulley with a bronze bushing.

The pulley and shaft were to be supported by a cylindrical boss with its centre 80mm above the centre of the shaft.

The cylindrical boss was to be assembled to the wall plate using machine screws with washers. Pulley tension adjustment was to be achieved by moving the boss vertically on the wall plate as indicated by the arrows X – X.

They were then asked to complete the design of the pulley adjuster, showing clearly the following:

(a) A bracket to secure the pulley and shaft

This could have been done by fabrication. The candidates who attempted the question produced various types of brackets and some displayed plausible solutions to securing the brackets. However, some candidates allowed the pulley to hang freely and attached things such as belts to the mechanism.

(b) A method of attaching the bracket to the boss

This aspect of the question was poorly done by a number of the candidates, while others had close to perfect solutions. Some candidates welded the components together, which was not the most suitable way of attaching the two components in such an assembly.

(c) The provision for vertical movement of the boss to tension the belt on the pulley

This aspect of the question was also poorly done as no provision was made for the movement of the boss by most of the candidates. Some candidates made the provision in the bracket that they designed, which was a plausible solution to the problem, and thus they were credited for their solution.

(d) The bronze bushing in place on the pulley

Some candidates used arrows to indicate where the bushing was but did not represent it on the sketches that they produced, while others made sketches but did not use the correct representation for bearings in the views drawn.

(e) The machine screws and washers in place to secure the boss to the wall plate

This aspect of the question was done by most of the candidates even though the sketches of the machine screws bore no resemblance to actual machine screws. Some candidates used four screws and placed them at the corners of the slots. This solution would restrict the movement of the boss as it would be held in one place without any provision for sliding.

(f) A means of securing the bracket so that the distance of 40mm between the pulley and the face of the boss was maintained.

This aspect of the solution was not done by most of those who attempted the question. This could have been done by inserting a stop 40 mm long between the two components.

Question1, which is compulsory, continues to be a problem for a large number of the candidates entered for the examination each year. 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 were 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. Some candidates attempted to produce detailed drawings using tee squares and set squares which would have been time consuming in a situation where only free-hand or ruler assisted sketches were necessary. Candidates should be encouraged to produce free-hand sketches of the assembly as their solutions to the problem.Figure 1 below indicates a possible solution to the problem.

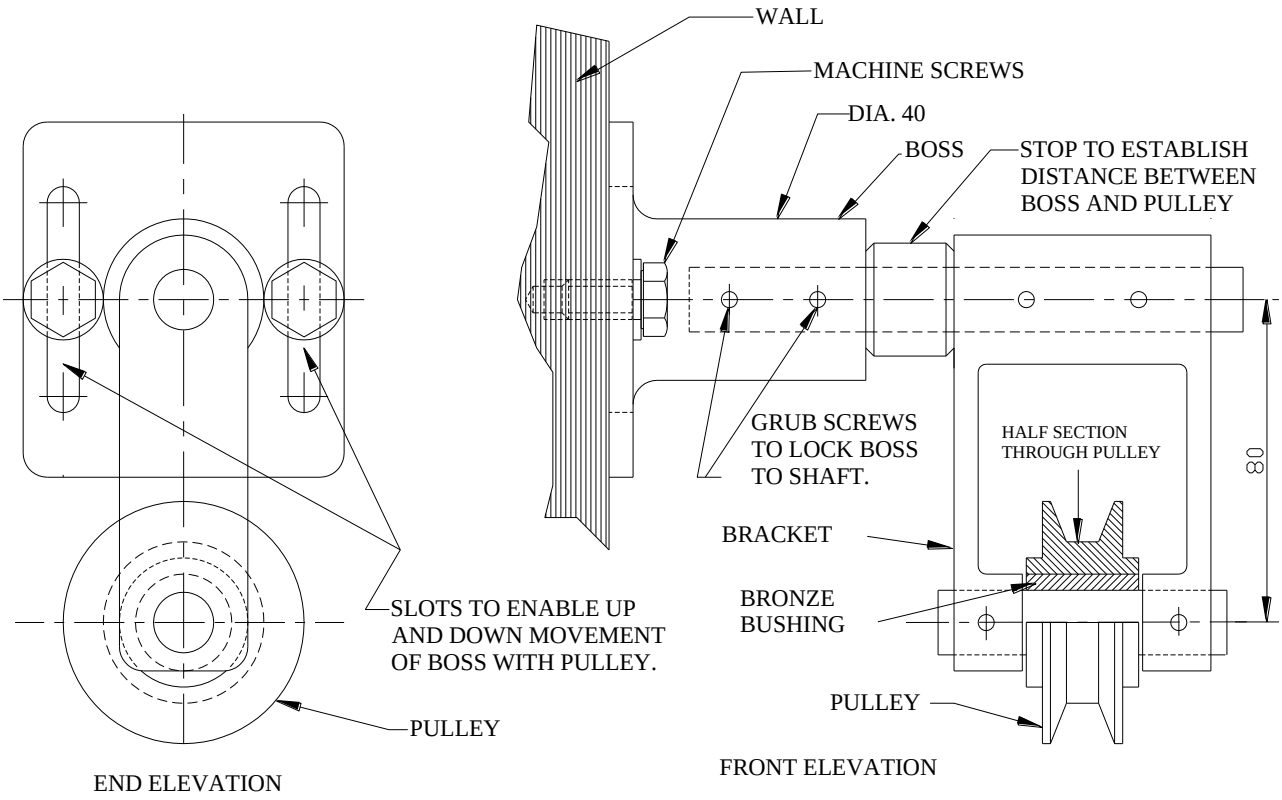


**FIGURE 1: POSSIBLE SOLUTION TO PULLEY ADJUSTER**

**Section B**

Question 2

The objectives of this question were to test the candidates' knowledge of:

(a) Sketching and indicating the components necessary for turning between centres

(b) The steps of procedure required to machine a given test bar between centres

(c) The calculation of the spindle speed required to machine the test bar

(d) (i) The procedure for using the test bar on the lathe to check the alignment of the lathe centres
(ii) Adjusting the lathe centres to produce parallel work

(e) Precautions that should be taken while turning between centres to prevent overheating and burning of the centres.

This was not a very popular question as it was attempted by only 43 per cent of the candidates.

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

- The calculation of the spindle speed required for machining the test bar
- Precautions that should be taken while turning between centres to prevent overheating and burning of the centres

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

- The steps of procedure required to produce the test bar
- The alignment of the centres
- Indicating the various components used to turn between centres on the lathe
- Differentiating between live and dead centres
- Identifying drive plate and lathe dog

The responses to the question gave an indication that a number of candidates are not familiar with turning between centres. A number of them believe that holding one end of the work in the chuck and supporting the other end with a centre is actually turning between centres.

Question 3

This question tested the candidates' knowledge of:

(a) The description of a method of finding the centre of a piece of cylindrical stock.

(a) (i) The steps of procedure for producing an M10 X 1.50 mm thread in a blind hole

(ii) How to calculate the tap drill size for an M10 X 1.50 mm thread

(b) (i) Sketching the profile of the teeth of four classes of files

(ii) Naming each class of file sketched in (b) (i)

(c) (i) The name given to the clogging of file teeth

(ii) A step that could be taken to minimize the clogging of file teeth

This question was attempted by 78 per cent of the candidates.

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

- Naming the classes of files
- Identifying the name given to clogging of file teeth and steps taken to minimize the problem.

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

- Method of finding the centre of the round stock
- Calculation of tap drill size
- The steps of procedure for tapping the blind hole
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Question 4

This question was designed 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 using chain drilling

(ii) The tools to be used in the process

(c) Precautions to be observed to ensure accuracy while marking out a component in sheet metal

(d) Safety precautions that should be observed while cutting out a slot in sheet metal

This question was attempted by 62 per cent of the candidates.

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

- 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
- Steps of procedure for marking out the template
- Precautions to be observed to ensure accuracy while marking out

Question 5

This question was designed to test the candidates' knowledge of:

(a) Methods other than soft soldering that could be used to join strips of brass

(b) Advantages and disadvantages of using soft solder to join strips of brass

(c) (i) Sketching the stages in the formation of a folded and grooved seam

(ii) Illustrating the development of a sheet metal component

(d) Safety precautions that should be observed while handling sheet metal

This was not a popular question as it was attempted by only 33 per cent of the candidates.

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

- Safety precautions that should be observed while handling sheet metal.
- Methods that could be used to join the strips of brass

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

- Illustration of the steps of procedure for laying out side "D".
- Sketching of the stages in the formation of the folded and grooved seam
- Statement of the advantages and disadvantages of using the soft soldering process to join sheet metal

Question 6

This question set out to test the candidates' ability to:

(a) (i) Calculate the recommended length of snap head rivets for assembling sheetmetal

(ii) Calculate the recommended length of counter sunk head rivets for assembling sheet metal

(b) List the steps of procedure for assembling components using countersunk and snap head rivets

(c) State methods of fastening other than riveting that could be used to join sheet metal components

(d) (i) Sketch the various types of cold chisels used in the workshop

(ii) Name each type of chisel sketched in (d) (i)

(iii) State the type of work performed by the chisels named in (d) (ii)

This question was attempted by 61 per cent of the candidates.

The majority of candidates demonstrated sound knowledge of the following:

- Safety precautions that should be observed while producing the assemblies
- Tools to be used for the 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 completing the riveting exercise
- Listing methods of fastening other than riveting that could be used to join sheet metal components

Question 7

This question was designed to test the candidates' knowledge of:

(a) The functions of the electrode coating in relation to making a successful weld

(b) Completing the following table to show cause and correction to the defects listed

| DEFECT | CAUSE | CORRECTION |
|---|---|---|
| (i) Excessive splatter | (i) | (i) |
| (ii) Poor fusion | (ii) | (ii) |
| (iii) Hard to start arc | (iii) | (iii) |

(c) Using sketches to illustrate the differences among the three types of flames used in oxyacetylene welding

(d) Safety precautions that should be observed while using oxyacetylene welding equipment

(e) (i) Using labelled sketches to illustrate

a) the preparation that had to be done to the edges of sheet metal plates that have to be butt welded together

b) a method of securing the pieces during the welding process

(ii) Explaining the procedure for butt welding the pieces together

This question was attempted by 42 per cent of the candidates.

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

- Sketches indicating the preparation that had to be done to the edges prior to welding
- Procedure for welding the pieces together
- Using sketches to illustrate the differences among the three oxyacetylene welding flames
- Safety precautions that should be observed while welding

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

- Identification of the functions of the electrode coating in relation to making successful welds
- Listing the causes and methods of correction for some welding defects
- Illustration of the methods of securing pieces during the welding process

Question 8

This question set out to test the candidates' knowledge of:

(a) Reasons why it is important to have a preventative maintenance schedule

(b) (i) Categories into which lubricants can be classified

(ii) Factors that will determine the choice of lubricants for a job

(c) Applications of the various categories of lubricants

(d) Using sketches to illustrate the differences among three common types of belt drives

(e) Giving an application of each belt drive indicated in (d).

This was not a popular question. It was attempted by 33 per cent of the candidates.

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

- Reasons why it is important to have a preventative maintenance programme
- Categories into which lubricants can be classified

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

- Factors that determine the choice of lubricant for a job
- Applications of the various categories of lubricants
- Differences among common types of belt drives
- Applications of different belt drives

Question 9

This question was designedto test the candidates' knowledge of:

(a) (i) Calculating the length of stock required to make a lifting hook

(ii) Using sketches to describe the steps of procedure for forging an eye

(iii) Tools to be used in the process

(b) What happened in each of the following cases involving foundry work:

(i) The pattern used was the same size as the casting to be produced.

(ii) The moulding sand in the mould was too dry.

(iii) There was loose sand in the mould cavity.

(iv) The pattern was produced without a draft angle.

This question was the least popular. Only 11per cent of the candidates attempted it.

Apparently,this section of the syllabus is not covered adequately by teachers in most schoolsand,as a result, it was poorly done by most of the candidates who attempted it.

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

- Tools to be used in the process of forming the eye on the 6mm diameter stock
- Sketch of cross-section of mould ready for pouring

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

- Calculating the length of stock required to make the lifting hook
- Describing the steps of procedure for forging the eye from the 6 mm diameter stock
- Explaining what happened in each of the following cases:

- The pattern used was the same size as the casting to be produced.
- The moulding sand in the mould was too dry.
- There was loose sand in the mould cavity.
- The pattern was produced without a draft angle.

Notes to Teachers

1. Question 1 which was based upon module B8 of the syllabus continues to be a problem for most of the candidates. Since this is a compulsory question and it is worth 40 marks candidates who do not attempt this question are at a disadvantage. Teachers therefore need to spend more time on this unit of the syllabus addressing those issues that frequently pose problems for candidates. This might be achieved by incorporating the following suggestions in their classroom activities:

   - Teachers should try to provide the engineering drawing experiences needed by students to interpret and understand the various scenarios involving drawing and sketching as required by the examination.
   - Students should be given exercises in designing which involve sketching and making models.
   - Students may be taken on field trips to various industries where aspects of mechanical devices/mechanisms not seen in the school workshop can be seen.
   - There are video clips available with some of these mechanisms; these could be shown to students in the computer labs in the various schools.
   - Students could be pointed to web sites for them to interact and familiarize themselves with the various mechanical components/mechanisms used in industry.
   - 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 things such as machine guards. It is important to remember, however, that machines must be shut down before these operations are carried out.

3. Where schools do not have all of the machines required for the programme, candidates can be taken to centres where they are available and can, at minimum, benefit from demonstrations of the uses of these machines.

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