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 2011

TECHNICAL DRAWING GENERAL PROFICIENCY EXAMINATION

GENERAL COMMENTS

In 2011, there was a slight increase in the number of candidates writing the examination, from 7,559 in 2010 to 7,569 in 2011.

Overall, there was a slight decline in candidates' performance. Although performance on the School-Based Assessment (SBA) (Paper 04) continues to be fairly good, there still remains room for improvement. Teachers are reminded to note the amendment to the syllabus (Appendix 1 – CXC 13/0/SYLL 005) which came into effect in 2006. This details the format for the SBA project and teachers are encouraged to follow the recommended mark scheme as grading of their students may be seriously disadvantaged.

Teachers are also reminded to adhere to standard drawing practices, especially for working drawings and assembly drawings, for all papers. A significant decline in drawing standards has been observed across all papers. Generally, the use of scales as well as lettering, labelling and dimensioning are areas which need to be emphasized and improved. When completing Working Drawings, all drawings must be fully labelled, annotated and dimensioned. In the case of Sectional Assembly Drawings, hatching lines to show various materials and cutting plane lines must be shown.

There appears to be some selection in the topics covered by teachers in preparing students for the examination. All topics outlined in the syllabus must be covered in order to ensure adequate preparation of students as this may seriously affect question selection. Also, teachers are encouraged to place emphasis on the reading and interpretation of question requirements. For example, in the Building Drawing (Paper 031 – Question 1) paper, candidates were presented with a Floor Plan and asked to produce the Roof Framing Plan for the given design. Many candidates reproduced the Floor Plan without taking note of the question requirements.

Again, recommendations are made for candidates preparing for the examination in Technical Drawing to acquire a background in at least one of the allied subjects of Industrial Arts. For example, a candidate choosing the Building Drawing option should be encouraged to also choose one of the Building Technology options. Likewise, a candidate choosing the Mechanical Drawing option should choose Mechanical Engineering at the CSEC level. This would no doubt strengthen the underpinning knowledge requirements of the subject area.

DETAILED COMMENTS

Paper 01 – Multiple Choice

This paper consisted of 60 multiple-choice questions testing the profile dimensions of Knowledge (Profile 1), Application (Profile 2) and Practical Ability (Profile 3). Candidates' performance in the 2011 paper showed a slight decline when compared with June 2010. The overall mean was 33.39 compared with 35.91 for June 2010. Marks ranged from 3 to 59 out of a maximum of 60.

Paper 02 – Plane and Solid Geometry

Plane Geometry

Question 1

Candidates were presented with the length of one side of a regular pentagon. This question was designed to test candidates' ability to:

(a) Construct the regular pentagon.

(b) Enlarge the regular pentagon to a similar figure with linear measurements of its sides in the ratio 3:5.

Generally, candidates who attempted this question demonstrated good knowledge of constructing the pentagon. However, some candidates were unable to enlarge the pentagon with measurements of sides in the ratio 3:5. In some cases, area ratio was drawn.

Teachers are asked to refer to Unit 1, Module III, Specific Objective 8 of the syllabus.

Question 2

Candidates were presented with information necessary for constructing a triangle. This question was designed to test candidates' ability to:

(a) Construct the triangle using the given information — lengths of sides.

(b) Draw three circles to touch each other using the vertices of the triangle as their respective centres.

Generally, candidates who attempted this question demonstrated good knowledge of constructing the triangle. However some candidates were unable to demonstrate knowledge of constructing the three circles to touch each other.

Teachers should refer to Unit 1, Module III, Specific Objective 1 and Module IV, Specific Objective 3 of the syllabus.

Question 3

Candidates were presented with a figure representing a simple link mechanism. This question was designed to test candidates' ability to:

(a) Copy the given mechanism.

(b) Plot the locus of point B as OA makes one complete revolution.

Generally, candidates demonstrated a good grasp of copying the mechanism and plotting the locus of B accurately, showing the rotation of AO, while AB slides through the pivot block C. However, some candidates experienced difficulty demonstrating knowledge of sliding AB through the pivot block C in order to plot the path of point B.

Teachers should refer to Unit 1, Module VI, Specific Objective 4.

Question 4

Candidates were presented with the longest radius (120mm) and shortest radius (20mm) for constructing one convolution of an Archimedean spiral. This question was designed to test candidates' ability to construct the spiral given the radii.

Generally, candidates demonstrated good knowledge of constructing the Archimedean spiral with the longest and shortest radii. However, some candidates demonstrated no knowledge of a spiral. In some cases, involutes and cycloids were presented.

Teachers should refer to Unit 1, Module VI, Specific Objective 6 of the syllabus.

Solid Geometry

Question 5

Candidates were presented with the first angle orthographic views of a Bracket and a reference line XY inclined at 45˚ to the horizontal. This question was designed to test candidates' ability to draw:

(a) The given front elevation and plan.

(b) An auxiliary elevation of the Bracket on the XY line.

Generally, candidates demonstrated a good grasp of drawing the given views. However, some candidates demonstrated limited knowledge of drawing an auxiliary elevation of the Bracket on the given line 'XY'. Candidates were also unable to demonstrate an understanding of projected lines, perpendicular to the auxiliary axis.

Teachers should refer to Unit 1, Module VIII, Specific Objective 1 as well as Module IX, Specific Objective 1 of the syllabus.

Question 6

Candidates were presented with a figure showing two orthographic views of a truncated regular hexagonal pyramid. This question was designed to test candidates' ability to draw full size:

(a) The two given views.

(b) The completed plan.

(c) The surface development of the pyramid with S-S as the seam.

Generally, candidates demonstrated an ability to draw the given views. However, some candidates were unable to complete the plan and determine the true length for the corners of the pyramid in order to draw the correct surface development.

Teachers should refer to Unit 1, Module VIII, Specific Objective 1 and Module X, Specific Objective 2 of the syllabus.

Question 7

Candidates were presented with the plan and incomplete elevation of a vertical cylinder penetrated by a horizontal cylinder. This question was designed to test candidates' ability to:

(a) Draw the given views.

(b) Complete the elevation showing the curve of interpenetration between the two cylinders and the face of the horizontal cylinder.

Generally, candidates who attempted this question demonstrated good knowledge and understanding of drawing the given views. However, some candidates also demonstrated limited knowledge completing the elevation showing the curves of intersection between the cylinders and the curves of the face of the horizontal cylinder.

Teachers should refer to Unit 1, Module VIII, Specific Objective 1 and Module IX, Specific Objective 5 of the syllabus.

Question 8

In this question, candidates were presented with orthographic views of a Machine Block. The question was designed to test candidates' ability to draw a cabinet oblique view of the block.

Generally, candidates who attempted this question demonstrated good knowledge of drawing a machine block in cabinet oblique. However, some candidates used the cavalier method of oblique drawing and/or the isometric.

Teachers should refer to Unit 1, Module VII, Specific Objective 1 of the syllabus.

Paper 031 – Building Drawing

Question 1

Candidates were presented with the outline of a floor plan for a two-bedroom, low-income residential project. The building was to be of concrete block construction and covered with a gable roof.

In Part (a), candidates were required to draw to a scale of 1:50, the Roof Framing Plan for building. The Working Drawing was to include the following:

- Foundation
- Floor
- Walls
- Roof
- At least three vertical dimensions

In Part (b), candidates were required to draw to a scale of 1:50, the Foundation Plan of the building. All sectional floor, foundation and footing details were to be shown.

A suitable title and scale used was to be printed at the base of each drawing. Specifications for all construction members were provided.

Many candidates demonstrated a high level of knowledge, understanding and ability in drawing the roof framing plan to a scale of 1:50, showing the given roof outline of a gable roof with a valley.

Although the foundation plan was generally well done, many candidates experienced some difficulty in identifying the footing and foundation wall. Dimensioning of the foundation plan was an area of weakness demonstrated by most candidates.

Other aspects of weakness were the quality of labelling of roof members, dimensioning techniques and the omission of the printed title and scale used as required by the question.

Many candidates responded to this question by reproducing the given floor plan instead of using the information given to produce the roof framing plan and foundation plan.

In producing the drawings for this question, most candidates did not adhere to the principles of good working drawing practice. Consequently, they were unable to score the maximum marks allotted for the question.

Teachers are reminded that this is the *Working Drawing* section of the examination. As such, standard drawing practices and conventions for completing working drawings are to be followed.

Question 2

Candidates were presented with the outline of a floor plan for a two-bedroom residence. The design of the roof was indicated on the drawing. The building was to be of concrete block construction.

In Part (a), candidates were required to draw to a scale of 1:50, the completed floor plan for the building to show:

- Internal and external walls
- Kitchen appliances, cupboards and cabinets
- All doors and windows
- Bathroom fixtures
- Closets
- Names of rooms
- Eight main external dimensions

In Part (b), candidates were required to draw the Front Elevation of the building to a scale of 1:50, to show clearly the design of the roof. The outline of the roof was shown in hidden detail on the given drawing.

A suitable title and scale used was to be printed at the base of each drawing. Specifications were provided for all construction members. Standard drawing practices and conventions for drawing floor plans and elevations were to be followed.

Many candidates demonstrated a high level of knowledge, understanding and ability in the drawing of the floor plan at a scale of 1:50. However, candidates seemed not to understand fully the use of scales, for example, although they drew the plan at the correct scale, in many cases, bathroom fixtures were drawn too small and were therefore not practical.

The inclusion of drawing features such as internal and external walls, doors and windows as well as kitchen appliances were aspects well done. Labelling of rooms and dimensioning techniques were also done satisfactorily.

Although the floor plan was generally well done, some candidates still seemed to be experiencing difficulty in interpreting the required elevation for the building. In most cases, they experienced difficulty in interpreting the roof design in elevation.

Other aspects of weakness included the quality of labelling, dimensioning techniques and the omission of the printed title and scale used as required by the question.

In producing the drawings for this question, most candidates did not adhere to the principles of good working drawing practice. Consequently, they were unable to score the maximum marks allotted for the question.

Question 3

Candidates were required to make a neat, well-proportioned, orthographic sketch of a timber straight flight stair. Sketches were to include the following main parts of the stair in elevation:

(a) Newel post

(b) Balluster

(c) Handrail

(d) String

(e) Tread

All main components were to be clearly shown and labelled.

The majority of candidates who attempted this question did a good job of executing the sketch in good proportion. Although most candidates were able to draw parts of a straight flight stair, some candidates could not label the parts correctly. Some candidates produced a concrete stair.

Attention must be given in the classroom to all aspects of the syllabus. Drawing of a wooden straight flight stair (Unit 2, Module IX, Specific Objectives 2 and 4) appears to be an area of weakness.

Question 4

This question tested candidates' ability to make a neat, well-proportioned three-dimensional sketch to illustrate:

(a) Aluminum guttering on closed eave

(b) Concrete coping on block wall

(c) Plywood sub-flooring on timber framed floor

All components were to be labelled.

Candidates who attempted this question demonstrated a good grasp of the concept of sketching in proportion. However, the majority of candidates were unable to sketch in pictorial correctly. Many candidates produced orthographic sketches.

Interpreting the various construction details was an area of extreme weakness. Teachers are reminded to ensure complete syllabus coverage in order to allow students to take maximum advantage of marks to be awarded.

In this case, the areas following are aspects of the syllabus which need to be emphasized.

Unit 2:

- Module I, Specific Objective 4
- Module V, Specific Objective 1
- Module VI, Specific Objective 1
- Module VII, Specific Objective 4

Paper 032 – Mechanical Engineering Drawing

Assembly Drawing

Question 1

Candidates were presented with an enclosed sheet showing first-angle, orthographic projection details of the parts, which make up a tool rest holder.

In Part (a), candidates were required to draw, full size, in first-angle or third-angle orthographic projection the following views of the tool rest holder when fully assembled:

(i) A plan

(ii) An end elevation looking from arrow A with all hidden detail shown

(iii) A full sectional front elevation taken on the cutting plane line, C – C

In Part (b), candidates were required to show six main dimensions, including a length, a diameter, a radius and a metric screw thread specification.

In Part (c), candidates were required to print the title, *Tool Rest Holder Assembly*, the scale used, and show the projection method used, by symbol.

Most candidates who attempted this question demonstrated reasonably good knowledge, application and practical ability in correctly positioning and aligning the views drawn in relation to the orthographic projection method used. In cases where candidates used Computer Aided Drawing (CAD), this was well done, though there were instances of candidates not completing the drawing process. Candidates demonstrated sound knowledge of, and the ability to apply engineering features such as fillets, screw threads and chamfers. In cases where candidates completed the assembly and sectional front elevation, the cross-hatching used to distinguish parts such as the locking screw, bolt and washer and the screw plate was well done.

Aspects of the question that were not well done included assembly of parts. Several candidates assembled the components incorrectly, for example some candidates assembled the screw plate where the locking screw was to be attached to the body. Other candidates placed the locking plate on the top portion of the body in various ways. It was clear, therefore, that some candidates had very little knowledge of mechanical engineering components and how they are constructed.

Another aspect that was not well done related to incorrectly hatching cut surfaces to distinguish between different components. Additionally, several candidates had difficulty indicating the correct

projection symbol according to the projection method they used. Attention must be paid to completing sectional drawings showing the cutting line.

Attention is drawn to Unit 3, Module VI, which identifies types of mechanisms with which candidates should become familiar.

Question 2

Candidates were presented with an enclosed sheet showing first-angle, orthographic projection details of the parts, which make up an adjustable pulley assembly.

In Part (a), candidates were required to draw, full size, in first-angle or third-angle orthographic projection the following views of the fully assembled adjustable pulley.

(i) A front elevation looking in the direction of arrow F with all hidden details shown

(ii) A full sectional, end elevation taken on the cutting plane line B–B

In Part (b), candidates were required to show six main dimensions, including a length, a diameter, a radius and a metric screw thread specification.

In Part (c), candidates were required to print the title, *Adjustable Pulley Assembly*, the scale used, and show the projection method used, by symbol.

Most candidates who attempted this question demonstrated reasonably good knowledge, application and practical ability in correctly positioning and aligning the views in relation to the orthographic projection method used. Assembly of the given components was also fairly well done, with most candidates positioning the components correctly. Candidates also showed good knowledge of, and application of the engineering features required: fillet, screw thread and chamfer.

Most candidates' application of and practical ability in cross-hatching to show details of the assembled Tool Rest Holder such as distinguishing parts, shafts and webs were well done. Candidates demonstrated good knowledge of dimensioning and that they could accurately apply the principles involved in dimensioning orthographic drawings. Linework was generally well done, with at least most linetypes required being evident.

Some candidates showed weakness in relation to assembling the pulley at the lowest possible position according to instructions. Other areas where some candidates showed weaknesses included poor sectioning and hatching line use to distinguish details of the assembly such as webs and shafts. Some candidates hatched the slot through which the shaft passed. Several candidates did not include the cutting plane line as required by convention. Additionally, several candidates had difficulty indicating the correct projection symbol according to the projection method they used. Candidates need to improve their linework and some dimensioning techniques.

Attention is drawn to Unit 3, Module VI, which identifies types of mechanisms with which candidates should become familiar. Additionally, attention is drawn to Unit 3, Module II.3 and Module IV.1.

Sketch and Design OR 3D Solid Model Design Drawing

Question 3

This question tested candidates' ability to use a neat, well-proportioned, isometric sketch to show the elevations of the given support bracket assembled with 'Y' as its lowest point.

Generally, candidates who attempted this question demonstrated good knowledge of elevations in orthographic projection and applied that knowledge to produce an appropriate isometric sketch with 'Y' as the lowest point. Some candidates ably produced the required circles and arcs in isometric and were able to accurately apply the inclined lines. Sketching to proportion was also generally well done.

Areas of weakness included candidates not demonstrating good practical ability in sketching isometric curves and circles. Some candidates had challenges completing these accurately even though knowledge of drawing isometric curves and circles was evident.

Attention is drawn to Unit 3, Module VII.2, which identifies types of engineering components which candidates should be able to sketch in 3D.

Question 4

This question tested candidates' ability to make neat, well-proportioned orthographic sketches to illustrate four of the following locking devices in application:

(a) Lock nut

(b) Self-locking nut

(c) Tab washer

(d) Spring washer

(e) Slotted nut

(f) Castle nut

Generally, performance on this question was poor. Candidates demonstrated limited knowledge of locking devices generally, but more specifically in application as required for the question. However, some candidates were able to produce well-proportioned sketches of the spring washer, slotted nut and castle nut, although in most instances the pin was not included in the sketch of the slotted nut and castle nut.

Attention is drawn to Unit 3, Module VII.1, which speaks to the need for candidates to be able to sketch the features of engineering components using standard graphic symbols.

Paper 032 – School-Based Assessment (SBA)

There has been a marked improvement in the performance of candidates in the 2011 SBA. Of the 233 centres moderated, grades for 163 were accepted while 70 had to be adjusted. Although the performance this year was good, there are still some centres where submissions made by students are not up to the required standard for the CSEC examination.

This improvement indicates that teachers have acknowledged suggestions made in previous subject reports and have been instructing students accordingly. However, although teachers have been complying with the recommendations, there are still some points, which need to be re-emphasized.

These include:

1. The drawing of objects/figures to scale

2. Omission of problem statements, conditions and justifications

3. Reproduction of drawings without any modifications

4. Incorrect dimensioning of objects (Dimensioning of orthographic views and floor plans, using measurements on the paper instead of actual dimensions — demonstrating a lack of understanding of scale)

5. Omission of dimensions (Some drawings were submitted without a single dimension)

Mark Scheme

Building drawing students as a general rule do not produce pictorial drawings. They are required to produce floor plans, sectional view, roof details, foundation plans and elevations. This therefore creates a problem when the CXC mark scheme is applied. A number of teachers have expressed concerns over the fact that the current mark scheme for the SBA does not allow for the adequate marking of Building Drawing. While the concerns of teachers are appreciated, it is recommended that all building students should submit a pictorial drawing to ensure maximum advantage on the mark scheme.

Appropriateness of Task

Any work given to students should be geared towards testing some aspect of the CSEC syllabus. Consideration should be given to the designing, researching and manufacturing (production) of the item or service. (**Note:** The task given should not be beyond the expected skill level of students at the CSEC level.)

In the case of building drawing, students should produce floor plans, sectional views, roof details foundation plans, pictorials and elevations. Mechanical drawing students should be expected to produce pictorial drawings, sectional elevations, orthographic projections and exploded views. Parts in the solution should also be clearly identified.

Submission of Problem Statements and Mark Schemes

Teachers are expected to ensure that each student's folder contains information on the problem being presented (problem statement, conditions and justifications). Teachers are also expected to submit the CXC mark scheme clearly showing how marks were awarded to each student. This can be achieved by submitting a copy of the mark scheme showing the allocation of marks in the categories of knowledge, application and practical ability.