UNIVERSITY OF MALTA

SECONDARY EDUCATION CERTIFICATE
SEC

TECHNICAL DESIGN

May 2007

EXAMINERS' REPORT

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

SEC Technical Design
May 2007 Session
Examiners' Report

Part 1. Statistical Information

The tables below show the distribution of grades for the May 2007 session.

Distribution of Grades

Table 1: Graphical Communication Option

Grade	1	2	3	4	5	6	7	U	Abs	Total
Paper1&2A	17	59	55	73	95	-	-	124	3	426
Paper1&2B	-	-	-	13	41	49	30	102	16	251
Total	17	59	55	86	136	49	30	226	19	677
%	2.5	8.7	8.1	12.7	20.1	7.2	4.4	33.4	2.8	100

Table 2: Technology Option

Grade	1	2	3	4	5	6	7	U	Abs	Total
Paper 1&2B	-	-	-	1	1	-	-	1	4	7
%	-	-	-	14.3	14.3	-	-	14.3	57.1	100

Table 3: All Candidates

Grade	1	2	3	4	5	6	7	U	Abs	Total
Candidates	17	59	55	87	137	49	30	227	23	684
%	2.5	8.6	8	12.7	20	7.2	4.4	33.2	3.4	100

Part 2: Comments regarding performance

2.1 General Comments

The examination consisted of two papers, paper 1 and paper 2, each of two hours duration. Paper 1 was common to all candidates. There were two versions of paper 2, 2A and 2B.

The aim of this report is to suggest practical tips to the students and teachers. It is evident that candidates do not always follow the instructions set in the question, or they do not read the question thoroughly. This point was repeatedly stressed in the previous examiners' reports. When the candidates cannot understand what is required of them, they then present solutions in a confused and unintelligible manner.

Drawing skills should be developed in order to present precise and accurate information. It seems that very little time is devoted to practice in class to achieve good draughting techniques. The proper use of instruments and pencil grades, especially the value of using relative line thickness with clear and consistent line density, is not given enough attention.

2.2 Specific Comments

Paper 1. Common Core

Question 1. (12 marks)
Candidates were required to construct a right-angled triangle, given the hypotenuse and a side of the triangle so as to complete the first part of the question. For the second part, candidates had to follow the three stages stipulated by reducing the quadrilateral geometrically to a square of equal area. Many candidates failed to demonstrate the ability to recall the simple basics required in order to complete the first part of the question. Others having managed to draw the quadrilateral, constructed a square without applying appropriately the principles of plane geometry.

Statistical information regarding this question:
Candidates opting for Paper 1 and Paper 2A:
1 % were absent.
33% did not attempt this question, or were awarded no marks.
42% only managed to get half of the marks (i.e. between 1 and 6 marks).
24% succeeded in obtaining high marks (i.e. between 7 and 12 marks).

Candidates opting for Paper 1 and Paper 2B:
6% were absent.
65% did not attempt this question or were awarded no marks.
24% managed to get half of the marks (i.e. between 1 and 6 marks).
5% succeeded in obtaining high marks (i.e. between 7 and 12 marks).

Question 2. (12 marks)
This was another question testing the candidates on their knowledge of plane geometry; in this case (i) the circle and its properties and (ii) tangency. This question tested the candidate's ability and skill to use the compass so as to produce an accurate drawing of a handle with clear construction and consistent line density in the outline. In this question the centres of several arcs of different radii were given and candidates were asked to draw other arcs to form one continuous curve blending smoothly with the given arcs. To some candidates the construction of tangential arcs to two unequal circles seemed too complicated. About 15% of the candidates were awarded no marks, 53% attained half of the marks and 25% managed to get high marks.

Question 3. (12 marks)
Before answering a question candidates must carefully read the whole question and examine the drawing in detail; then work so as to make steady progress without mistakes. Very fast work can become very careless. Some candidates presented the outline of the ellipse freehand, with no construction whatsoever. There are several established methods of drawing an ellipse, and candidates were asked to leave the construction clear so as to show which method they employed; this was very often neglected. Candidates are also expected to know the different parts of the ellipse, yet they failed to indicate the position of the foci as instructed. The tangent to the ellipse is a simple straightforward

construction. Some merely referred to the given figure and drew a line to the curve, without any construction lines and without the use of the foci. All that was required of them were two neat light lines and a bisector. When examiners stress the point, that construction lines are to be left showing the method used, this does not mean that these construction lines are to be drawn as bold, black and thick as the outline of the figure.

Question 4. (15 marks)
Not a popular question, with only a minority of candidates attempting it. A good number of the candidates left this question out, without even drawing a single line. Two common right geometrical solids were shown; a cylinder and a cone sectioned by a common plane A-B. One expects that similar practical examples to the one presented here, were very frequently worked out by students throughout the course as class exercises. The cylinder and the cone were sectioned producing a curve for each solid which was joined by a common chord. Some students seeing the circle in the plan, immediately divided the circle into twelve parts and stopped there. Two main methods of construction were employed; the horizontal slices and the generators method. The given isometric sketch seemed to be of great help to some candidates as they visualized the question better. No major mistakes in the orthographic projection symbol were encountered. It was very encouraging to come across solved solutions of high standard presentation, even though few.

Question 5. (15 marks)
The question refers to the projection of a sectional front elevation from a given plan and side views. Despite the given pictorial drawing some candidates failed to detect the correct general outline of the component. Others produced an outside elevation, whereas a small number even ignored the web, treating it just like ordinary material being sectioned by a cutting plane. Other pitfalls were the hatching of the four end journal holes and the use of hatching lines inclined at angles other than 45°. A considerable number of candidates did not even recognize the type of orthographic projection used in the question.

Question 6. (14 marks)
The question asked for the construction of the locus of the end point of a rod forming part of a mechanism. A large majority did well, scoring highly and even full marks. Most unsatisfactory solutions resulted because the candidates did not recognize the function of the swivel. Solutions produced by the trammel method could not be credited.

Question 7. (20 marks)
The question tested techniques used in estimated perspective drawing, particularly the task of dividing an area into a number of smaller equal receding panels (like the cupboard doors and floor tiles). Most students approached this task by the method of successive division (halving) using two crossing diagonals. This only works, when the required number of panels takes the form of 2 raised to any power, i.e. 2, like 2,4,8,16,32, etc.
This method therefore proved useful with the left bottom cupboard but not for the floor tiles, which used six equal divisions. Some candidates showed not even a minimum knowledge of perspective drawing as they represented the receding cupboard doors by

dimensionally-equal panels, obtained by using the method of dividing a line into a number of equal parts.

2.3 Technical Design paper 2A and 2B - Graphical Communications Option

Question 1. (10 marks)
A complete sample of a decorative border was given. Candidates were instructed to complete the given decorative border on the given started lines by copying and drawing a similar pattern to the one given. They were furthermore asked to select an appropriate colour of their own free choice and show their mastery in applying a colour to the pattern constructed. The construction of the involute of the square/hexagon was definitely not a difficult task, considering the fact that a sample involute was already printed on the paper. A number of candidates got the involute totally wrong. Marks were deducted for not producing a uniform width of the pattern, some decided to alter the width and finished off the border 5 mm wide. To complete the exercise candidates were asked to colour the pattern. Many of the candidates preferred to use their pencil to colour the pattern.

Question 2. (14 marks)
A start and finish of a helical ramp were printed, together with a drawing of a practical example of a helical car ramp. Undoubtedly one of the most important loci is the helix, yet students seem to ignore or forget the principle and construction of the helix. Some of the drawings presented indicated that the candidates had no idea of the method of solution for this question. Some merely tried to copy the helical band from the given example, without drawing any construction lines. Some managed to divide the pitch into twelve parts, but did not include any construction in the half plan. On the other hand, a good number managed to solve the question and got high marks.

Question 3. (12 marks)
Part of a boundary wall and a barbed wire fence were illustrated. Candidates were required to design a suitable warning sign to be placed on the wall. This was a popular question with a significant proportion of candidates demonstrating their skillful use of colour and shading, presenting excellent artistic interpretations. It seems however that, there are candidates who lack the knowledge to translate from written instructions into graphic form, expressing their ideas so as to represent their design concept graphically. Some candidates were not aware that the background colour of warning signs must be yellow and the triangular order band should be black. Any symbols used are to be placed centrally and should be black in colour.

Question 4. (16 marks)
First angle orthographic views of two triangles joined along a common side were presented in this question. Candidates were to (i) find the true lengths of each side of the triangles and (ii) having successfully mastered the first part of the question, complete the solution by drawing a one-piece development of the two triangles on the given fold line.
Dealing with the true lengths of a line seemed difficult for the candidates. Students must be familiar with this topic, recognize when a line is a true length and be capable of finding the real length of the line when it is represented by an apparent line. To construct the development of a right pyramid and a right cone a student must obviously be familiar with the method of finding the true length of the line. These constructions must not be neglected and must be repeatedly applied until the method is mastered. A good number of candidates opting for paper 2B did not attempt this question, and did not even manage to draw a single line. On the other hand, there were other candidates who managed to construct all the true lengths accurately, and completed the second part of the question by drawing the development as requested. It is in the best interest of the candidates that when attempting questions of this type, they make the method of construction they used to solve the question absolutely clear and neat.

Question 5. (18 marks)
In paper 2A a musical conductor's stand represented by a simple line drawing in the front elevation and a detailed elaborated plan were shown. The plan was symmetrical about the horizontal centre-line. From the two given views candidates were required to produce only half of the auxiliary plan. The line of sight was clearly indicated on the front elevation by an arrow and a letter S. The examiners were pleased to note that this question was generally well answered by most of the candidates who got excellent results. More attention must be given to the presentation of the drawing regarding the composition of construction lines and smooth execution of the curves.

In paper 2B a baby grand piano with the lid open was presented in the front elevation and an incomplete plan was shown. Starter construction lines with arrows indicating and showing how to complete the plan, were given to help the candidates solve the first part of the question, by drawing the inner profile of the piano. Unfortunately, some candidates did not understand this step and did not finish the first part of the question. They lost half of the total marks. In the second part of the question candidates were required to project from the front elevation an auxiliary plan, by taking a few construction lines on the plan and projecting these lines on the auxiliary plan. Only projection of the open piano lid was required, as the rest of the drawing was already given. This auxiliary projection exercise was not a popular question with a minority of the candidates. Although other candidates did try to attempt this question they did not present the correct drawing of the auxiliary plan. Construction lines in this type of question need to be drawn very neatly and measurement must be measured accurately from the plan.

Question 6. (12 marks)
In paper 2A a diagram of four rowboats towing a barge was shown and in paper 2B three rowboats were shown pulling a barge. Candidates were required to represent the three/four forces acting at the same point by vectors and draw the polygon of forces so as to find graphically the magnitude of the resultant/equilibrant force. To complete the second part of the question, they had to measure the magnitude, convert the result from millimeters to newtons and jot down the result. This topic seems to have been given its due importance, for this seemed to be a very popular question, generally well-answered by the majority of the candidates who opted for paper 2A. In contrast, some candidates had no idea of the method required for such a solution and did not attempt it. Others merely copied the given diagram as presented on the paper instead of drawing the polygon of forces. There were some solutions with inaccurate measurement, others failed to draw the vectors in sequence and got incorrect results.

Question 7. (18 marks)
Interpenetration of two geometrical solids, one being vertical and the other horizontal, the axis of both being at right angles to each other, were represented by a practical example of a perfume bottle. In paper 2A a cylinder placed vertically was shown penetrating an octagonal prism. In paper 2B an octagonal prism replaced the vertical right cylinder. Both cases were drawn in third angle orthographic projection, and in both cases a complete plan and a complete end elevation were given together with a partially prepared front elevation. In this question candidates were to employ a general method, which is employed to many cases of intersecting solids and determine the missing lines of intersection in the front elevation. After completing the first part of the question they then had to draw a half surface development of the geometrical solid set vertically. This question, although a popular and very important topic, presented very poor results. This was true especially for candidates opting for paper 2B who in most cases got no marks at all. A good number of candidates attempted this question but very few produced anything approaching a good answer. A large number of candidates were able to make some solid constructional progress, like the projection of lines from the plan to the end elevation and dividing the circle in the plan into twelve equal parts; but then they got stuck. Often the development was not appropriately constructed and more often than not candidates failed to project the correct dimension from the elevation. Many candidates only got half of the marks, for obtaining the length of the development correctly. Increased effort should be made so that simple cases of developments of common prisms and right cylinders are familiar to candidates. Furthermore candidates are to be guided when and where special extra points are to be included when solving interpenetration problems since not every problem is solved accurately by taking twelve equal parts.

Chairperson
Board of Examiners
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