L-Università
ta' Malta

Examiners' Report
SEC Graphical Communication

Main Session 2019

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A. STATISTICAL INFORMATION

The total number of candidates who registered to sit for Graphical Communication was 410. Of these registrations, 312 opted for Paper IIA and 98 opted for Paper IIB.

Table 1 shows the distribution of grades for the Main 2019 session of the examination

GRADE	1	2	3	4	5	6	7	U	ABS	TOTAL
PAPER A	26	57	59	67	55		-	41	7	312
PAPER B	-	-	-	8	23	15	11	22	19	98
TOTAL	26	57	59	75	78	15	11	63	26	410
% OF TOTAL	6.3	13.9	14.4	18.3	19.0	3.7	2.7	15.4	6.3	100.0

Table 1: Distribution of grades for Graphical Communication 2019 Main Session

B. General Remarks on the Written Examination

Paper 1 consisted of six questions which covered the following topics (including the average attainment relative to the total marks):

1. plane geometry (92.4%);
2. polar enlargement (79.1%);
3. circles in contact / tangential lines / ellipse (59.3%);
4. sectional machine drawing and dimensioning (49%);
5. triangle constructions and rendering (53.8%);
6. two-point perspective (67.2%).

Ranked in order of difficulty, the average marks attained in questions 1, 2, 7 and 3 were above 67%. The average attainment in question 5 was 54% and that of question 4 was 49%. This indicates that in the plane geometry and polar enlargement questions candidates fared very well. The two-point perspective question is very popular amongst candidates and the circles in contact/tangents/ellipse question followed behind. It is suggested that more time is allocated in class to work on triangle constructions and rendering as in general the performance in question 5 was poor. Performance in the sectional machine drawing, question 4, indicated that the majority of candidates (and in particular those sitting for paper 2B) are still struggling and educators need to stress the importance of this topic and related sectioning principles / standard conventions. Part of question 4 was also about dimensioning but many candidates struggled with this part of the question.

Paper 2 consisted of seven questions which covered the following topics (including the average attainment relative to the total marks):
1. computer graphics (77.8%);
2. ideograms, charts & graphs (69.8%);
3. freehand and orthographic projection (59.9);
4. involute and Archimedean spiral (40%);
5. true lengths and surface developments (36.5%);
6. assembly (60.1%);
7. auxiliary projection (42.3%).

As per previous years, the question 1 computer graphics question was the one that most candidates fared well in. Question 2 came in as a close second, with the average for both questions at and above the 69% mark. In the assembly (question 6) and freehand orthographic projection (question 3) candidates scored above average at around 60% in both questions. Of particular note is the assembly question that for the first time featured a parts list and a non-freehand solution. The data shows that this question was welcomed very well amongst candidates. In question 7, 4 and 5 candidates attained an average mark below the average of 42% to the lowest at 36%. Candidates fared badly in the auxiliary, involute and spiral questions and worst still in the true lengths and surface developments one. This was a common trend since performance in previous examinations showed that candidates found difficulty to solve problems related to true lengths and solid geometry. It is suggested that this topic is given more importance in class and would suggest the use of cardboard modelling techniques to address this lacuna.

The following is an overall general list of shortcomings noted by the markers:

*   Lack of time management with particular emphasis in Paper 2.
*   Lack of differentiation between construction lines and outlines.
*   Confusing the involute with the Archimedean spiral construction techniques.
*   Lack of proportions when drawing freehand sketches.
*   Lack of dimensioning knowledge.
*   Lack of proper colouring and shading techniques.
*   Lack of knowledge of engineering standards and conventions.
*   Lack of problem-solving skills.
*   Lack of knowledge on true lengths and surface developments.
*   Lack of overall neatness with some candidates producing very smudgy solutions.
*   General feeling that several candidates do not read the question thoroughly but instead rush to produce a solution.

C. COMMENTS ON PAPER I AND PAPER II

Paper 1

Question No.1 – Plane geometry (10 marks)

A small illustration of a clock face with Roman numerals with a six-pointed star at the centre was given. The starting lines of an enlarged version of the clock face were also given. The candidates were asked to complete the clock face by drawing the twelve tick marks and the central star consisting of six equal rhombi.

Performance in this question was good and most candidates produced flawless solutions. However, other candidates lost marks by:

- ignoring part (a) of the question which instructed them to draw the tick marks;
- not realising that the star consisted of six equal rhombi thus drawing a different version of the six-pointed star;
- drawing a lot of unnecessary geometric constructions which resulted in confused solutions. The instrument required to answer this question efficiently was the 30° / 60° set square or the drafting head set at 30° / 60°.

The table below shows the performance of the candidates regarding question 1.

	0	1 - 4	5 - 9	Full marks	Abs	Total
Option A	0	0	106	199	7	312
Option B	0	6	42	31	19	98

Question No.2 – Polar enlargement (18 marks)

This question featured the enlargement of a figure using the polar enlargement method. A clock tower featuring a rectangular base section, a rectangular column with a circular watch, an upper rectangular column with two windows, a semi-circular dome and a long finial where given. Candidates had to construct a larger clock tower given the finial already enlarged. The majority of candidates showed adequate understanding on how to use radial lines and parallel lines to enlarge the clock tower. The most common difficulties for the candidates were to find the centre and radii of the clock circles and the correct positioning of the two windows. Another point worth mentioning was that some candidates completely erased radial lines or did not show all their working. A number of candidates did the opposite by constructing thick/dark radial lines making it difficult to see the enlarged result of the clock tower, thus losing marks on neatness.

The table below shows the performance of the candidates regarding question 2.

	0	1 - 10	11 - 17	Full marks	Abs	Total
Option A	1	32	166	106	7	312
Option B	7	25	40	7	19	98

Question No. 3 – Circles in contact / tangential lines / ellipse (20 marks)

This question consisted of the profile of a Jet Ski, with the lower half consisting of a semi-ellipse while the top half consisted of geometrical constructions of tangents and tangential arcs.

In this question, candidates were examined on their knowledge of the Ellipse, Internal Tangents between two circles of different diameters, tangents between a point and a circle, tangential arcs (touching circles) and the correct handling of the compasses and instruments.

Tangents and Tangential arcs – The Candidates were given the centre of two circles which had to be drawn. Then they were required to construct an internal tangent between the circles, a tangent from one of the circles to a given point and 2 tangential arcs.

Almost all candidates attempted this question with only a few leaving this part of the question completely blank. However close to half of the candidates attempted to draw the tangents without doing the required construction thus losing valuable marks.

Common Mistakes – Tangents and Tangential arcs

- Drawing of tangents without construction.
- Some candidates drew in freehand over their compasses arcs which resulted in an inaccurate and dirty looking work.
- Drawing Tangential arcs without first locating the centre of circles.

Ellipse - The candidates were required to draw the semi-ellipse from a given Major and Minor axis and after constructing the ellipse, they were then required to construct a Tangent to the ellipse.

Most of the candidates attempted this question with the greater majority opting for the Concentric circles method of constructing the ellipse. However, many did not continue on to locate the focal points which were required to construct the Tangent to the ellipse.

Common Mistakes – Ellipse

- A good portion of the candidates did not locate the focal points and instead drew a tangent without the required construction.
- The freehand curve of the ellipse was either too dark or not drawn smoothly.

The table below shows the performance of the candidates regarding question 3.

	0	1 - 10	11 - 19	Full marks	Abs	Total
Option A	2	72	206	25	7	312
Option B	0	59	20	0	19	98

Question No. 4 – Sectional machine drawing and dimensioning – (16 marks)

In this question, candidates were examined on their knowledge of Orthographic Projection drawing, Sectional Principles and Dimensions. Candidates were given an Isometric view, a complete Plan and a profile of the Front of a 'Guide Bracket'. Performance in this question was average. Most candidates projected lines from the given Plan view to the missing view, successfully locating the webs and drawing the holes correctly. Responses indicated that a good number of candidates did not realise that the 'Bracket' had 2 webs and only drew the one on top. Others did not see the 'saw cut' and subsequently when hatching, they hatched the saw cut too. A small number of candidates did not realize the question was about sectioning at all and instead tried to draw the Front view of the 'Guide Bracket' instead of the sectional view.

Common Mistakes – Sectioning

- Missing centrelines and fillets.
- Hatching in different directions.
- Hatching over saw cut.

Dimensioning – Candidates were also required to draw 2 Radial and 2 Linear dimensions on the Orthographic view. The greater majority did not attempt dimensioning at all. The few who attempted this part of the question did so with mixed results. While the measurements were mostly correct some wrote down the dimensions in centimetres whilst others mixed the symbols for Radius and Diameter, thus writing down the wrong dimension for a circle. Others just wrote a number at the side or at the bottom of a line without markings, arrows or any sort of dimensioning principle.

Common mistakes – Dimensioning

- Writing just the number without the arrow, leaders or the nature of the quantity (MM).
- Writing the dimensions in centimetres.
- Writing the dimension on the isometric view instead of the Orthographic view.

The table below shows the performance of the candidates regarding question 4.

	0	1 - 7	8 - 15	Full marks	Abs	Total
Option A	1	109	190	5	7	312
Option B	8	60	11	0	19	98

Question No. 5 – Triangle construction and rendering (18 marks)

This question featured a science experiment setup. Candidates had to complete the drawing. Two marks were allocated for writing the name of a shown quadrilateral, being a trapezium. Three marks were allocated for constructing an equilateral triangle TUV with point V as the vertex, sides 69 mm and base TU horizontal. Four marks were allocated for finding, by construction, the centre of an arc KL and completing the arc. Five marks were allocated for constructing a triangle WYX using the compasses only. The triangle had a given base WX, angle YWX = 75º and a perimeter of 160 mm. Finally, four marks were allocated to render the Bunsen burner and the stand as if they were made out of shiny metal.

The following are a number of errors which were noted:

a) Some candidates did not give the name of the quadrilateral (trapezium).
b) A good number of candidates did not know how to use two chords to find the centre of an arc.
c) The majority of candidates did not know how to construct a triangle given the base, base angle and perimeter.
d) A significant number of candidates did not know how to render. Candidates did not know how to use colours for making a realistic Bunsen burner and the stand as if they were made out of shiny metal. Instead they just gave the items some colour or used their pencil without considering light and shadows to give the material a shiny look.

The table below shows the performance of the candidates regarding question 5.

	0	1 - 10	11 - 17	Full marks	Abs	Total
Option A	1	150	146	8	7	312
Option B	2	65	12	0	19	98

Question No.6 - Perspective drawing (18 marks)

An isometric and two orthographic views of a nappy changer were given. The candidates were asked to draw a two-point perspective view of the object. The two vanishing points and the front corner were given.

Most of the candidates used correct methods of foreshortening and answered this question correctly. Other candidates lost marks due to the following reasons:

• no foreshortening of the sides resulting in distorted proportions;
• confused foreshortening methods;
• drawing a planometric projection instead of perspective;
• lack of neatness and accuracy.

Prospective candidates are reminded that, apart from drawing lines converging to the vanishing points, the sides of the object are to be foreshortened and its components are to appear shorter and thinner as they recede.

The table below shows the performance of the candidates regarding question 6.

	0	1 -10	11 - 17	Full marks	Abs	Total
Option A	1	74	164	66	7	312
Option B	4	48	27	0	19	98

Paper 2

Question No. 1 - Computer Graphics (10 marks)

Most candidates in both papers were able to score more than half of the marks allocated for this question.

In the case of paper 2A, most candidates were able to fill in the missing commands requested of them in the first part of the question, showing the capability of translating drawn lines into commands if needs be. Marks were lost mainly due to missing vertical and horizontal dashes when mirroring was executed. Other marks were lost due to poor outlining of colour using unsharpened pencils. This last aspect was also noticed with candidates sitting for paper 2B.

Only a small number of candidates failed to attempt the question completely. The majority of candidates sitting for papers 2A and 2B had a correct understanding of the given commands and were able to execute the given design in the appropriate space on the provided grid.

The table below shows the performance of the candidates regarding question 1.

	0	1 - 4	5 - 9	Full marks	Abs	Total
Option A	6	22	214	63	7	312
Option B	8	10	40	20	20	98

Question No. 2 – Ideographs, Charts and Graphs (12 marks)

Very few candidates demonstrated a high level of execution and inventiveness when drawing freehand sketches and developing these into final solutions.

Most of the freehand sketches presented in papers 2A and 2B fell short of effectively filling the provided space, resulting in sketches which were too small and appropriately recognisable.

In both papers, marks were lost due to:

- drawing less than three sketches per item or none;
- poorly executed final solutions;
- not choosing the best sketch idea for development;
- lack of colour in the final pictograms.

Most candidates in both papers were able to rightly fill in the icon column in the provided table. On the other hand, a number of these candidates failed to notice that the vertical axis on the pictograph was in multiples of two, resulting in the wrong calculation of the star ratings in the table and in drawing twice of the stars needed on the graph.

The table below shows the performance of the candidates regarding question 2.

	0	1 - 6	7 -11	Full marks	Abs	Total
Option A	1	55	229	20	7	312
Option B	0	14	56	8	20	98

Question No. 3 – Freehand and orthographic projection (10 marks)

This question consisted of two parts. In the first part the candidates were asked to sketch in freehand the Orthographic projection views of a given object in Isometric. In the second part candidates were asked to do the opposite and draw an Isometric projection of an object which was presented to them in Orthographic projection.

In the first part of this question, many candidates have omitted views and confused or ignored first angle projection placing. Particularly in paper 2B, candidates did not draw in freehand but used a straight edge which is not allowed. In paper 2B, many candidates were confused by the line dividing the inner wall and the base of the matchbox. Those candidates have drawn a line in the plan as if the inner part of the matchbox was a solid block and another line had been drawn on its top part. In paper 2A a surprisingly large amount of candidates rotated the plan 90 degrees which also cost them marks.

In the second part of the question, marks have been lost again for drawing with a straight edge in both papers. Marks have been also lost due to candidates leaving out details especially the inner part of the object in paper 2B. As the object in paper 2A was slightly more difficult, many fared badly due to lack of understanding the object's 3D properties and drawing it misshaped. Some candidates in paper 2A have rotated the object and drawn it from an incorrect angle.

The table below shows the performance of the candidates regarding question 3.

	0	1 - 4	5 - 9	Full marks	Abs	Total
Option A	4	57	225	19	7	312
Option B	4	43	31	0	20	98

Question No. 4 –Involute and Archimedean spiral (16 marks)

The candidates were asked to plot the involute of a circle. Responses indicated lack of practice both in method and freehand. It was noted that a good number confused constructing the tangents with the normals. The compasses method was used by a few candidates while the majority preferred to use the freehand method.

The candidates had to draw two Archimedean spirals offset by 5mm. Since two points where given, many candidates confused the division between A1, B1, A2 and B2 respectively. Many mistakes were common, that of dividing from A1 to B2 into 12, resulting in missing points. Also, the simple division of a line method was frequently confused and not neatly presented by a good number of candidates. This may show that candidates are not prepared to having alterations from the original simple one line Archimedean spiral.

The table below shows the performance of the candidates regarding question 4.

	0	1 - 7	8 - 15	Full marks	Abs	Total
Option A	22	142	141	0	7	312
Option B	19	49	10	0	20	98

Question No. 5 – True lengths and surface developments (16 marks)

In this question candidates were presented with an orthographic front and partial plan of a truncated triangular pyramid. Continuation of the plan, true lengths, true shape and development were expected to be done by candidates.

It was noted that a good number of candidates didn't find the appropriate true length of the side. Strangely enough, candidates mostly focused on the true lengths of the cut. With reference to the end view, a good number confused the hidden detail. The apex was also not drawn in the appropriate position.

The true shape was challenging for a lot of candidates, with very few noting that the true shape can be measured from the development. Others confused the development of a pyramid with that of a prism and construction lines for the development were projected straight. A small number of candidates constructed the development in the form of a cone divided in 12 parts.

Considering that this topic featured frequently in previous examinations, performance in this question was lacking indicating no knowledge or confusion of true lengths, plotting a proper development and understanding true shapes. It is suggested that candidates work more on solid geometry questions and understand the related concepts in detail.

The table below shows the performance of the candidates regarding question 5.

	0	1 - 7	8 - 15	Full marks	Abs	Total
Option A	24	143	138	0	7	312
Option B	30	44	4	0	20	98

Question No. 6 – Assembly (18 marks)

In this question, candidates were asked to draw the assembled front view and the plan (paper 2A only) of a model rocket which has been presented to them in exploded isometric view. The candidates had the bill of material of the parts in Orthographic projection.

In both papers, candidates were asked to draw the front elevation. The mistakes in this part were common with most candidates offsetting the side fins by 5mm outwards as presumably they did not realise that they should have fit the opposite slots in the main body. To a lesser extent, candidates have also drawn the top cone above the main body. Hidden edges have been ignored and sometimes drawn incorrectly. More notable was the fact that almost all candidates have drawn the main body of the object straight, when in fact it should have had two very small offsets at the sides where the fins fit in.

In paper 2A, candidates have additionally been asked to draw the plan of the assembly. Marks have been lost due to omitting internal parts of the four fins and the base's corner chamfers. Of particular interest is the amount of candidates drawing the two offset squares inaccurately, resulting in poor looking bases in the plan.

The table below shows the performance of the candidates regarding question 6.

	0	1 – 10	11 - 17	Full marks	Abs	Total
Option A	7	105	178	15	7	312
Option B	9	35	32	2	20	98

Question No. 7 – Auxiliary Projection (18 marks)

Most candidates were able to start off by projecting lines from the Plan towards line $X_1 Y_1$, and then lining the bottom steps of the bell tower as requested.

In the case of the middle arch, there were only a few candidates that divided the semi-circle into a number of sections in order to project these onto the Plan and Auxiliary elevation accordingly. Moreover, in the case of candidates sitting for paper 2A, this happened also with the side quadrants. For almost half of the candidates sitting for paper 2A, the top protruding part of the bell tower was executed with either the correct width and the wrong height or vice-versa.

A number of candidates sitting for both papers failed to finish off the depths of the bell tower, producing a two-dimensional drawing instead. Most of those who did project the depth of the drawing, failed to include the depth of the middle arch. Very few candidates were able to obtain the full marks allocated for this question, with even fewer presenting a neat solution.

The table below shows the performance of the candidates regarding question 7.

	0	1 – 10	11 - 17	Full marks	Abs	Total
Option A	20	183	84	18	7	312
Option B	14	53	8	3	20	98

Chairperson
Examiners Panel 2019