L-Università ta' Malta

MATSEC
Examinations Board

Examiners' Report

SEC Graphical Communication

Main Session 2024

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A. STATISTICAL INFORMATION

The total number of candidates who registered to sit for Graphical Communication was **465.** Of these registrations, **333** opted for Paper 2A and **132** opted for Paper 2B.

Table 1 shows the distribution of grades for the Main 2024 Session of the examination.

GRADE	1	2	3	4	5	6	7	U	ABS	TOTAL
PAPER A	27	55	65	63	50	-	-	58	15	333
PAPER B	-	-	-	16	10	18	14	44	30	132
TOTAL	27	55	65	79	60	18	14	102	45	465
% OF TOTAL	5.8	11.8	14.0	17.0	12.9	3.9	3.0	21.9	9.7	100.0

Table 1: Distribution of grades for SEC Graphical Communication, Main 2024 Session.

B. GENERAL REMARKS

General Remarks on the Written Examination

Sixty one percent of the candidates who sat for the Graphical Communication exam achieved a grade of between 1 and 5. Seven percent attained a grade of between 6 and 7, while twenty two percent failed this examination. Ten percent of the candidate were absent.

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

1. plane geometry (68%);
2. basic constructions and polygons (79.6%);
3. sectional machine drawing and dimensioning (50.4%);
4. surface developments (49%);
5. ellipse and circles in contact (55.4%);
6. two-point perspective (49%).

Candidates fared best in question 2, with an average attainment score of 79.6%, with a close score in question 1 of 68%. The rest of the questions lagged significantly behind with the ellipse at 55.4% and the rest around the 50% average attainment mark. This shows that candidates did best in the geometry exercises, while they can do better in the other areas. It is notable also that candidates fared better in surface developments than in previous years, possibly indicating an optimistic outlook.

Paper 2 consisted of seven questions which covered the following topics (including the average attainment score relative to the total marks):

1. computer graphics (81.6%);
2. pictograms and charts (77.5%);
3. cycloid and helix (64.4%);
4. vectors (32.5%);
5. loci mechanisms (27.4%);
6. intersection of solids (40.4%);
7. auxiliary elevations (34.3%).

As per previous years, candidates fared particularly well in the computer graphics question with an average attainment of 81.6%. Candidates did particularly good in pictograms & pie charts and cycloids and helix, having an average attainment of 77.5% and 64.4% respectively. Candidates fared below average in the intersection of solids question, while they did very badly in the rest of the questions. One should note the lack of ability to draw loci mechanisms and their skill to foresee the temporal stages of the moving parts. It is highly suggested that teachers devote more time and expose candidates to mechanism animations in order to fill this gap.

C. COMMENTS ON PAPER I AND PAPER II

Paper I

Question 1 – Plane Geometry (10 marks)

In Question 1, most candidates demonstrated competence and accuracy in drawing circles, yet many responses indicated difficulty with constructing regular hexagons, often producing irregular shapes. Less than half of the candidates successfully constructed the tangent from a point outside a circle. Some candidates attempted to draw tangent lines from point 'P' without following the proper construction steps, while others showing limited understanding of the 'tangent from a point construction' but failed to complete it correctly. Additionally, some candidates made several confused attempts at construction, which did not lead to a correct solution.

	0	1 - 4	5 - 9	Full marks	Abs	Total
Option A	2	25	219	70	17	333
Option B	4	23	69	2	34	132

Table 2: The performance of candidates in question 1

Question No.2 – Basic constructions and polygons (14 marks)

Candidates were asked to follow the five stages listed below to construct a given logo.

a) Construct a regular pentagon using a given side.
b) Divide the given base into 5 equal parts using the division of the line method.
c) Draw construction lines parallel to the sides of the pentagon.
d) Add a triangle within the pentagon as shown on the starter sheet.
e) Outline the lower part of the logo as shown on the starter sheet.
f) Outline the upper part of the logo as shown on the starter sheet.
g) Shade the given logo using colour.

Most candidates demonstrated good ability in constructing a regular pentagon, primarily utilizing the 72-degree external angle method. They adeptly divided the baseline into five equal parts using the appropriate method. Furthermore, they accurately incorporated the triangle within the pentagon and correctly outlined both the upper and lower parts of the logo.

On the other hand, many candidates demonstrated inadequate shading abilities. Several used a clutch pencil for shading, resulting in significant gaps between the strokes. A well-sharpened HB pencil or coloured pencil would have been more suitable, allowing for consistent pressure application throughout the section. Additionally, some candidates shaded beyond the outlines.

	0	1 - 6	7 - 13	Full marks	Abs	Total
Option A	7	15	129	165	17	333
Option B	8	22	54	14	34	132

Table 3: The performance of candidates in question 2

Question No. 3 – Sectional machine drawing and dimensioning (20 marks)

In this question, candidates were tested on their knowledge of sectioning and dimensioning.

The question required candidates to:

a) Complete a sectional front elevation of a toy pulley including all centre lines.
b) Insert one linear and one radial dimension.

Not all candidates attempted this question with some leaving it completely unattempted. Among those who attempted it, the majority were successful in outlining the webs and completing the base. However, outlining the webs of the pulley was more difficult and many did not outline the pulley correctly. Only a handful managed to draw the pin correctly. The most common mistakes were:

1) sectioning the pin.
2) not including the centre lines.
3) not inserting the linear and radial dimensions.

A few candidates tried to draw the front elevation without sectioning it. Many candidates left out entire sections of the question (like inserting the dimensions or the centre lines).

	0	1 - 10	11 - 19	Full marks	Abs	Total
Option A	4	127	185	0	17	333
Option B	21	57	20	0	34	132

Table 4: The performance of candidates in question 3

Question No. 4 – Surface developments – (18 marks)

The candidates were given the front elevation, an incomplete plan, and an incomplete end elevation of a truncated cone used to support a rod. They were asked to:

a) Label the end elevation and the plan.
b) Construct the plan.
c) Project the end elevation.
d) Construct the full development of the truncated cone.

This question assessed the candidates' understanding of the principles of first angle orthographic projection and the surface development of truncated cones. Generally speaking, poor performance was noted, with the main difficulties being:

1. In the front view of the cone, the generator lines at the base were not extended to the vertex of the cone; instead, they were drawn as straight lines, resembling the parallel generator lines of a cylinder.
2. The cut in the plan was not properly constructed.
3. The cut in the end view was not properly constructed.
4. The development of the truncated cone, where many candidates failed to accurately determine the true lengths from either the front or end elevations.
5. Transferring the true lengths marking the corresponding radial lines on the development.
6. Some candidates drew folding lines on the cone's development.

	0	**1 - 10**	**11 - 17**	**Full marks**	**Abs**	**Total**
Option A	2	179	133	2	17	333
Option B	13	78	7	0	34	132

Table 5: The performance of candidates in question 4

Question No. 5 – Ellipse and circles in contact (18 marks)

In this question, candidates were required to use their knowledge of tangential arcs to construct the outline of an airship. The airship was attached to a zeppelin that consisted of an ellipse which had to be constructed. Furthermore, candidates were then required to construct a normal and a tangent to the ellipse in order to complete the zeppelin.

The candidates had to:

a) Draw circles whose radii and centres were given.
b) Locate the centres and draw circles tangential to given lines.
c) Draw circles tangential to a point or to each other by adding or subtracting the radii as necessary.
d) Construct the ellipse using the given major and minor axis.
e) Locate the focal points and construct a Normal and a Tangent to given points on the ellipse.

Most of the candidates attempted this question. When drawing the airship, most candidates successfully depicted the R15 and R80 circles. The R12 radius corners were also correctly drawn, with only a few candidates either omitting them entirely or attempting to locate the centres without any proper

construction. However, the R20 and R30 tangential arcs presented more of a challenge, with a considerable number of candidates making errors. Some candidates attempted to locate the required centres by trial and error, subsequently falsifying the construction, which resulted in no marks being awarded. Others drew freehand over the circles, leading to a loss of marks.

Most of the candidates successfully drew the ellipse, with many employing the concentric circles method of construction. However, a lot of candidates did not locate the focal points, instead attempting to draw the normal or tangent using alternative methods or omitting the construction altogether. Several candidates attempted to draw the normal by bisecting part of the ellipse's outline, as if constructing a perpendicular line on a given point on a line, but no marks were awarded.

Most common mistakes were:

a) Calculating incorrectly the radii when drawing tangential arcs.
b) Inaccuracy and mistakes when using the concentric circles method.
c) Dirty, bold or thick freehand in the ellipse.
d) No evidence of construction to find the Normal and Tangent; instead, just drawing them at random.

	0	1 - 10	11 - 17	Full marks	Abs	Total
Option A	2	135	145	34	17	333
Option B	5	79	13	1	34	132

Table 6: The performance of candidates in question 5

Question No.6 –Two-point perspective (20 marks).

In Question 6, candidates were tested on their skill of estimating a well-proportioned view of a two-point perspective drawing. Most candidates used the correct method of foreshortening.

Most common mistakes were:

a) Candidates joined the measuring points to the vanishing points instead of the mid-point on the horizon line. This resulted in a greatly distorted (squeezed) proportions of the kiosk.
b) A considerable number of candidates, for some unknown reason, reduced the size of the kiosk by up to 50%. The space provided on the question paper was sufficient to fit a full-size drawing.
c) Some candidates did not use any foreshortening and used full-size dimensions while converging the orthogonal lines towards the vanishing points. This flawed method resulted in greatly distorted (elongated) images of the kiosk.
d) Responses indicated that some candidates may have the wrong impression that two-point perspective drawings are to be drawn below the horizon line. These candidates squeezed the height of the kiosk to fit below the eye level line. This, once again, resulted in distorted drawings. The correct solution to the question given had to be drawn above and below the eye level.

	0	1 -10	11 - 19	Full marks	Abs	Total
Option A	2	140	144	30	17	333
Option B	10	75	10	3	34	132

Table 7: The performance of candidates in question 6

Paper II

Question No. 1 - Computer Graphics (10 marks)

2A:

- Most candidates presented correctly drawn answers.
- Some candidates missed or erroneously plotted some commands.
- A certain number of candidates left their pencil colours unsharpened, resulting in lines which were too broad and untidy.
- Some candidates smudged colour pencils on the pattern, resulting in work which was also not neat.

2B:

- Several candidates missed plotting certain commands or plotted them wrongly.
- Answers could have been much neater.
- A couple of candidates filled in the patterns in pencil colour rather than outlining them.

	0	1 - 4	5 - 9	Full marks	Abs	Total
Option A	5	8	193	111	16	333
Option B	18	11	46	22	35	132

Table 8: The performance of candidates in question 1

Question No. 2 – Pictograms and charts (16 marks)

2A:

- Several candidates did not follow the examples given, drawing pictograms devoid of the human figure. This resulted in loss of marks. They should have followed the style of the examples given.
- A considerable number of candidates left their final rendition of the pictograms in pencil rather than black.
- Most of the pie charts and graphs were rightly drawn.
- Many failed to obtain the marks for neatness. Colour application of both charts left much to be desired.
- Some of the drawn graphs were sub-standard, like not being properly drawn in isometric as they should have.

2B:

- Both the sketches and pictograms were way below standard.
- Some candidates ignored the examples given and neglected the human figure in their renditions.
- Most of the bar graphs were not drawn with instruments, resulting in bars which were not vertically aligned.

	0	1 - 7	8 -15	Full marks	Abs	Total
Option A	1	11	264	41	16	333
Option B	0	9	82	6	35	132

Table 9: The performance of candidates in question 2

Question No. 3 – Cycloids and helix (14 marks)

2A:

Cycloid

- Many candidates erroneously took the length of the circumference to be the distance from point P to point Y, drawing the cycloid wider than it should have.
- Several freehand renditions of the cycloid (the joining of moving points) were below standard.
- Some candidates failed to mark the moving points correctly. Others drew the cycloid without passing through all the obtained points.

Helix

- Several candidates marked the vertical divisions incorrectly.
- As in the case of the cycloid, most freehand renditions of the helix were below standard.
- Several candidates marked the wrong points through which the helix had to pass.

2B:

- Most cycloids were constructed incorrectly. Candidates divided the circle in a number of parts and drew the horizontal lines, then progressed by inventing all sorts of constructions which had nothing to do with the drawing of cycloids.
- Several candidates even used the wrong radius for the R16 circle.
- Most candidates did not project the perpendicular lines for the involute of the square.
- Some candidates drew the involutes in freehand.

	0	1 - 6	7 - 13	Full marks	Abs	Total
Option A	7	56	188	66	16	333
Option B	14	39	41	3	35	132

Table 10: The performance of candidates in question 3

Question No. 4 – Vectors (14 marks)

2A:

- Several candidates copied the given space diagram instead of drawing a vector diagram.
- A great number of those who drew the sketch of the vector diagram, did so rather carelessly, not respecting in any way the inclination of the vectors.
- Most candidates who came very close in answering the question correctly did not take the forces parallel to the vectors given, ending with magnitudes which much differed from the correct ones.
- Several candidates who constructed the vector diagram correctly did not convert the forces to reflect the scale in which they were drawn.

2B:

- Many candidates left this question out completely.
- There were only a couple of right answers drawn. Some did not keep the inclination of the vectors correctly or marked their lengths wrongly.
- Several candidates copied the given crane diagram, either in the space allotted for the sketch or else in the main working space.

	0	1 - 6	7 - 13	Full marks	Abs	Total
Option A	39	166	109	3	16	333
Option B	53	36	6	2	35	132

Table 11: The performance of candidates in question 4

Question No. 5 – Loci mechanisms (12 marks)

2A:

- Many candidates have confused this mechanism with a crank and piston mechanism.
- The other candidates either did very well, or very poorly in this question.
- Candidates who have started out somewhat on the right track but produced a vague solution have been awarded only a few marks.

2B:

- This question required candidates to demonstrate their understanding of how a mechanism works from given information and a schematic diagram.
- Many candidates have shown that they are familiar with the topic but have mistaken the sliding pivot with a slider.
- Many have worked out the question as if the mechanism was a sort of crank and piston, which it was not. Marks have been lost due to this mistake, which was by far the most common.
- Many candidates only obtained a few marks for starting out well but not finishing the question. It is also worth noting that many candidates did not attempt this question at all.

	0	1 - 6	7 - 11	Full marks	Abs	Total
Option A	52	204	31	30	16	333
Option B	54	26	16	1	35	132

Table 12: The performance of candidates in question 5

Question No. 6 – Intersection of solids (16 marks)

2A:

- Many have attempted this question with minimum success.
- Candidates have shown good understanding of the topic in general or at least an idea of the concepts involved.
- The most common shortcoming was that many candidates did not leave a gap at the bottom of the cylinder's development.
- In general, candidates did better with the development of the cylinder rather than that of the prism. It was satisfactory to note that candidates did take extra points as required to work out the development as well. Neater work is expected.

2B:

- This question, being a combination of two topics which are very different in their nature, allowed for good grading.
- Some candidates left this question out completely and others fared very poorly. Very few candidates have demonstrated any kind of knowledge regarding what was required to work out the solution.
- In the end elevation, candidates did a lot better. The most notable mistake was that most have drawn the line of intersection with the curve touching the edge of the cylinder, not realizing that there is a small horizontal part protruding inward.
- Regarding the signage and the colouring, most candidates have drawn these correctly, except for a few who have drawn signs in various random colours not complying with standards.

	0	1 – 7	8 - 15	Full marks	Abs	Total
Option A	20	178	117	2	16	333
Option B	6	64	26	1	35	132

Table 13: The performance of candidates in question 6

Question No. 7 – Auxiliary elevations (18 marks)

2A:

- Many candidates did well with this question and have shown a good understanding of this topic. Some lower achievers' mistakes have nevertheless shown some lack of understanding.
- Some candidates have projected lines from the end elevation to the left side of the corbel for example, or others have not divided the quadrants into parts.

2B:

- This question proved difficult for most candidates, as many responses indicated lack of knowledge how to work out an auxiliary view.
- Many candidates merely projected a few lines between orthographic views and stopped there, indicating a sever lack of understanding of this topic.

	0	1 – 10	11 - 17	Full marks	Abs	Total
Option A	27	182	79	29	16	333
Option B	29	64	4	0	35	132

Table 14: The performance of candidates in question 7

D. CONCLUDING COMMENTS

The examiners note that, in general, candidates need to focus more on the principles and contents of Graphical Communication in a holistic manner and to ensure that the following shortcomings are addressed. Regrettably the examiners would like to point out that the list below is a recurrent feature in many reports. With better effort and avoidance of these common minor mistakes, it is a general feeling that candidates can fare much better in their exams.

- Poor knowledge of basic geometric constructions.
- Lack of reading the question thoroughly and following through with all instructions. A possible solution would be to recommend candidates to tick the steps in the question once done, so as to keep a clear track of their progress.
- Many attempts made by trial-and-error method. This is unacceptable especially in a subject that requires a high degree of accuracy. This mistake should be avoided at all cost.
- Lack of proper colouring and shading techniques. This 'artistic' skill needs to be practiced more often and in greater detail.
- Lack of overall neatness with some candidates producing very smudgy solutions. Perhaps needless to say, but the use of two pencils to distinguish between construction lines and bold outlines is of utmost importance.
- Lack of dimensioning knowledge. Candidates are encouraged to study the proper dimensioning in ISO standard.
- Lack of knowledge of engineering standards and conventions. Most of the common mistakes are candidates hatching webs/ribs/pins cut across and omitting centre lines.
- Lack of knowledge on true lengths and surface developments. Constructing proper true lengths is a pre-requisite to complete the questions, and many candidates start off on the wrong foot.
- Very poor skills in drawing a one-piece full surface development. Candidates working out and then cutting out the models of these tasks to produce the solid models has proven to be helpful by many educators.
- Lack of overall time management. Examiners notice frequently that some candidates produce very good solutions but only few of them. Many a time, it is mathematically better to obtain good marks from multiple questions than near perfect marks from only a few.

Chairperson
Examination Panel 2024