



L-Università
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MATSEC
Examinations Board



Examiners' Report

SEC Graphical Communication

Main Session 2022

Examiners' Report (2022): SEC Graphical Communication

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A. STATISTICAL INFORMATION

The total number of candidates who registered to sit for SEC Graphical Communication was **410**. Of these registrations, **302** opted for Paper 2A and **108** opted for paper 2B.

Table 1 shows the distribution of grades for the Main 2022 session of the examination.

GRADE	1	2	3	4	5	6	7	U	ABS	TOTAL
PAPER A	16	55	62	74	52	-	-	42	1	302
PAPER B	-	-	-	9	21	13	14	36	15	108
TOTAL	16	55	62	83	73	13	14	78	16	410
% OF TOTAL	3.9	13.4	15.1	20.2	17.8	3.2	3.4	19	3.9	100

Table 1: Distribution of grades for Graphical Communication 2022, Main Session

B. GENERAL REMARKS

General Remarks on the Written Examination

Seventy 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 nineteen percent failed this examination. Four percent of the candidates who registered for SEC Graphical Communication were absent.

C. COMMENTS ON PAPER I AND PAPER II

Paper I

Paper I consisted of seven questions, which covered the following topics (including the average attainment score relative to each respective question for both paper A and paper B):

Question no.	Topic	Paper A candidates	Paper B candidates
1	Plane geometry	80.4%	63.1%
2	Circles in contact	66.2%	35.8%
3	Determination of areas	20.5%	2.1%
4	Ellipse	52.6%	19.6%
5	Sectioning	59.6%	29.8%
6	Developments	35.7%	11.7%
7	One-point perspective	63.9%	45.7%

Table 2: General performance in Paper I

Paper II

Paper II consisted of seven questions, which covered the following topics (including the average attainment score relative to each respective question for both paper A and paper B):

Question no.	Topic	Paper A candidates	Paper B candidates
1	Computer graphics	84.7%	69.9%
2	Cycloids	62.7%	31.8%
3	Ideograms	68.4%	69%
4	Vectors	71.1%	32.4%
5	Graphs and charts	86.2%	78.6%
6	Intersection of solids	44.5%	31.9%
7	Isometric drawing	56.6%	31.7%

Table 3: General performance in Paper II

D. CANDIDATES' PERFORMANCE IN PAPER I

Question No.1 – Plane geometry (10 marks)

This question featured a geometric logo consisting of a centrally placed hexagon inside a framed square. The hexagon had six sectors centrally attached to each external corner. The whole logo was shaded to give an interlacing effect. The candidates were expected to construct and shade this logo.

This question tested the candidates' ability to divide a line into a given proportion, measure accurately, construct a hexagon on a given base, bisect one side of the hexagon, draw six R10 circles, and finally shade a smaller version of the logo given on the same sheet.

There were quite a few very good solutions which had neat faint construction lines, bold /sharp outlines, and sensitive rendering. Other presented solutions had the following shortcomings.

- Some candidates failed to geometrically divide one side of the given square in the ratio of 1:7:1. Some completely ignored the given instruction while others divided the line by mathematical calculations. This resulted in loss of marks.
- While most candidates managed to construct the hexagon correctly, there were others who erroneously constructed irregular hexagons using the 45° set square. Others simply copied the hexagon by using a ruler, set at an approximate angle, and produce a shape vaguely similar to the given hexagon.
- Some candidates did not bisect geometrically the base of the hexagon to find its mid-point. These candidates either used the division of a line method or simply measured the base with their ruler.
- Several candidates did not outline the final design and left the drawing in a construction stage. Others drew all construction lines in bold. Some candidates used unsharpened pencils which produced thick and low-quality lines.

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- e. Some candidates shaded the given logo in a very insensitive manner. The candidates were expected to manifest their skill in shading a gradual value scale from very light to relatively dark. Instead, several candidates applied block colours with haphazard line strokes.

	0	1 – 4	5 – 9	Full Marks	Abs	Total
Paper A	0	5	239	57	1	302
Paper B	1	84	77	3	15	108

Table 4: The performance of candidates in question 1

Question 2 – Circles in contact (12 marks)

This question featured an electric vehicle charging sign made from circles in contact and tangential arcs. The drawing required candidates to:

- a. draw circles whose radii and centers were given;
- b. locate the centers and draw circles with given points of tangency;
- c. draw circles tangential to each other by adding or subtracting the radii as necessary.

The majority of candidates attempted this question with moderate success. Most managed to draw the R20 and R40 circles whose centres were given. They were also able to locate the centres and draw the R12 and R15 circles whose points of tangency were also given. However, locating the centre of the R60 and the R105 circles proved more difficult. Many candidates erroneously tried to locate the centre of the R60 tangential arc by bisecting the given line 'A-B'. Another common mistake was to attempt to locate the centre of the R105 circle by adding or subtracting the wrong radii.

Some candidates tried to locate the required centres by trial and error, and then proceeded to add the construction work afterwards. This resulted in no marks being awarded. Marks were also deducted for drawing outlines in freehand over the profile of the arcs.

	0	1 – 5	6 – 11	Full Marks	Abs	Total
Paper A	1	82	162	56	1	302
Paper B	8	58	25	2	15	108

Question 3 – Wooden Key holder (14 Marks)

This question consisted of a two-piece key holder composed of an irregular pentagonal back and a curved base. The candidates were expected to:

- a. convert the pentagon marked (a) into a square having the same area and then to complete Table A;
- b. use the mid-ordinate method to find the area of the curved base marked (b) and then to complete Table B.

Most candidates performed poorly in this question. The main shortcomings were:

- a. understanding the principle that triangles sharing the same base and having their apexes drawn within the same set of parallel lines have the same area;

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- b. lack of knowledge in converting a triangle to a rectangle by keeping the same base and halving the altitude of the triangle;
- c. converting a rectangle into a square by drawing a semi-circle spanning half the perimeter of the rectangle and extending the shorter side of the same rectangle toward the semi-circle.

With regard to the second part of the question, most candidates failed to find the area of the curved base marked (b) using the mid-ordinate method. This shows that knowledge of this method is particularly lacking. A number of candidates also calculated the area incorrectly by altering the centimetres with the millimetres.

	0	1 – 6	7 – 13	Full Marks	Abs	Total
Paper A	150	101	36	14	1	302
Paper B	82	10	1	0	15	108

Table 5: The performance of candidates in question 3

Question 4 – Ellipse (14 Marks)

This question featured the profile of a toy rocket. It consisted of a part ellipse with two tangents representing the nose, and two normal forming part of the landing gear. Candidates had to construct the part ellipse using any recognized method, add the tangents and normal after finding the focal points, and then complete the bottom part of the landing gear.

Most candidates managed to construct the part ellipse accurately. However, only a very few managed to locate the focal points and construct the normal and the tangents correctly. Since the major axis of the ellipse was vertically oriented, some candidates erroneously located the focal points on the minor axis instead. A good number of candidates tried to construct the normal and tangents without locating the focal points first. Others simply drew lines parallel to the given landing gear. Some candidates drew freehand sketches of the toy rocket with no constructions at all, earning no marks.

	0	1 – 6	7 – 13	Full Marks	Abs	Total
Paper A	19	126	148	8	1	302
Paper B	37	48	8	0	15	108

Table 6: The performance of candidates in question 4

Question 5 – Sectioning (14 Marks)

In this question a pictorial view of a cast support bracket was given. The plan, the end elevation, and the profile of the sectional front elevation were also given. Candidates had to:

- a. complete the sectional front elevation of the support bracket on cutting plane M-M;
- b. insert **ONE** radial and **ONE** linear dimension on any of the orthographic views;
- c. show all centre lines and ignore hidden detail.

Most candidates performed well in this question. However, the following shortcomings were noted:

- a. Some candidates failed to construct the outline of the counter bore cylinder.
- b. Several candidates failed to add fillet radii and centrelines.

- c. Some candidates hatched the ribs and the web even though the cutting plane ran longitudinally through them. (BS308 states that a web/rib is not to be hatched if it lies longitudinally to the cutting plane).
- d. Several candidates failed to hatch the webs that were sectioned across the cutting plane.
- e. Some candidates failed to hatch material at 45° lines.

With regard to dimensioning, many candidates either failed completely to insert the radial and linear dimensions or have done so not according to standard. The following points are worth noting:

- a. Extension and dimension lines should be thin and continuous, without middle gaps.
- b. Arrowheads should be sharp, bold, and filled in.
- c. Small gaps should be left between the extension lines and the orthographic view.
- d. Where possible, dimension lines should be located outside the drawing.
- e. The measurement should be expressed in millimetres and always placed above and slightly off the dimension line.
- f. Vertical dimensions are always viewed from the right-hand side of the drawing.
- g. The symbol **R** should be placed before a radius and the symbol \varnothing should be placed before a diameter.

	0	1 – 6	7 – 13	Full Marks	Abs	Total
Paper A	3	83	200	15	1	302
Paper B	37	48	8	0	15	108

Table 7: The performance of candidates in question 5

Question 6 – Developments (18 Marks)

This question featured incomplete orthographic and surface developments of a recycling bin composed of a rectangular based prism connected to a rectangular based pyramid truncated at the top.

Candidates were expected to complete (a) the front elevation by adding a regular octagon in a square, and (b) the plan by adding the truncation and a trapezium on one of the sides. Candidates also had to complete the surface development of the prism by including the octagon and the surface development of the truncated pyramid after finding the appropriate true lengths.

Some candidates left this question out completely, and from those who did attempt an answer, only a few obtained a reasonable amount of marks. Most of those who attempted this question managed to draw the surface development of the prism, including the legs, but found difficulties in completing the plan. They were also unable to locate the true length of the pyramid in order to complete the surface development of the lid.

Candidates were expected to draw the octagon on the front elevation in a given square. Many of the methods used were incorrect, with some candidates trying to divide the sides of the square in 3 equal parts or else trying to visually guess the length of the sides of the octagon.

A number of candidates drew pictorial sketches in the space where the plan was supposed to be drawn. Others simply ignored the given start lines for the surface development of the pyramidal lid and tried to join this to the surface development of the prism resulting in significant loss of marks.

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The most common shortcomings were:

- a. Failing to obtain the true length of the pyramid by proper construction methods.
- b. Failing to construct the development of the pyramid.
- c. Inability to complete the plan.
- d. Erroneously connecting the surface development of the pyramid to that of the prism.

	0	1 – 8	9 – 17	Full Marks	Abs	Total
Paper A	16	213	65	7	1	302
Paper B	24	68	1	0	15	108

Table 9: The performance of candidates in question 6

Question 7 – One-point perspective (18 marks)

This question dealt with one-point perspective drawing. It featured two pictorial and two orthographic views of a locker room with two showers on the right, eight lockers on the left, and a long bench in the middle. The outer frame, four corner tiles, the back window, and the ceiling were given. Even though only a few candidates managed to obtain full marks to this question, the majority did very well. Marks failed to be awarded for the following reasons:

- a. The perspective floor grid was not properly constructed. Some candidates erroneously used the division of line method to divide the depth of the room. This resulted in tiles appearing larger as they receded away from the viewer, which is contrary to the rules of perspective. Moreover, when furniture was then added on the incorrect perspective floor grid, it drastically appeared disproportioned.
- b. Some candidates did not interpret the given views correctly and drew the contents of the room higher, lower, wider, or narrower than requested. Some of the contents were misplaced forward, backward, or sideways on the floor grid.
- c. Another common mistake was that of drawing the facets of the contents of the room facing the viewer. Some candidates got confused which lines should point towards the vanishing point and which lines should remain vertical or horizontal.
- d. A frequently noticed mistake was the way that the height of the bench was determined.
- e. Some shower cubicles were drawn without curtains and with the shower trays drawn flush to the floor.
- f. Some candidates did not distinguish between construction and outlines; they either left all lines faint or drew all lines in bold. Maximum marks were given to candidates who, after drawing all the lines correctly, lined with a sharp outline the contents of the drawing, including the floor tiles, leaving all projection lines faint.

	0	1 – 8	9 – 17	Full Marks	Abs	Total
Paper A	2	75	219	5	1	302
Paper B	7	35	50	1	15	108

Table 10: The performance of candidates in question 7

E. CANDIDATES' PERFORMANCE IN PAPER II

Question 1 – Computer graphics (10 Marks)

Question 1 (option A) featured four sets of ACI commands with three different colours. Candidates had to use the commands together with the assigned DATA set to draw the top left corner of a coat of arms. This design had to then be reflected both vertically and horizontally.

Overall, most candidates presented a good solution to this question, with the vast majority doing well. However, weaker solutions featured:

- wrongly plotted data;
- wrong use of specific colours;
- no colours used;
- lack of precision and neatness;
- use of markers instead of well-sharpened colour pencils;
- filling the whole design with colour.

It is to be noted that quite a number of candidates presented diagonally mirrored images, as they thought that they should combine the vertical and horizontal mirror lines to create a 'new' diagonal mirror line.

With regard to the question featured in paper 2B, six sets of ACI commands and a vertical mirror line were given for candidates to produce the logo for a boat insurance company. Even though some candidates fared well, the variation between marks was greater and more evenly spread. Some candidates did not attempt this question or else presented very weak solutions. Marks were mainly lost due to the:

- inversion of the X and Y axes;
- freehand use of pencils;
- application of smudgy colours;
- invention of new designs, completely ignoring the given commands.

	0	1 – 4	5 – 9	Full Marks	Abs	Total
Paper A	5	11	177	108	1	302
Paper B	6	8	64	15	15	108

Table 8: The performance of candidates in question 1

Question 2 – Cycloid (14 Marks)

This question featured the design of a skateboard ramp using the concept of cycloids. With regard to candidates opting for paper 2A, these had to plot the locus of a point on a circle rolling in an anticlockwise direction for half a revolution, slide for 70 mm, and continue to roll anticlockwise for another half of a revolution.

Most candidates did well in this question, however a good number of candidates confusingly used the construction for a helix to obtain the path of the moving point, instead of the proper construction used for cycloids. This shows lack of understanding of the various types of loci, with candidates trying to memorize construction methods instead of reasoning out their discrete movements.

Several candidates managed to draw the first half but failed to properly construct the second half of the rotation. This might have happened due to the 70 mm sliding of the circle in between. Another important point that should be mentioned is the ambivalence in plotting the central steps of the moving circle. A number of candidates did not mark these distances using either the chord distance or by dividing the horizontal length of the circumference into twelve. As previously remarked, this shows a lack of understanding of the principal movements of the various types of loci.

In the question featured in paper 2B, candidates had to plot a cycloid with a point stationed on a circle rotating anticlockwise while travelling from left to right. This time the moving circle made no rests but kept on rotating in an anticlockwise manner for one revolution.

A good number of candidates showed understanding of the movement and divided the circle into twelve, projecting horizontal lines from each division. As the case with candidates in paper 2A, several candidates in paper 2B plotted the twelve central steps of the moving circle unequally spaced. Moreover, some of these failed to properly mark the path of the moving point.

It should be noted that more emphasis should be made on the use of freehand drawing when joining the points forming the cycloid. When it came to naming the curve, only a few candidates managed to remember its proper name, with others using a concoction of words pertaining to other topics.

	0	1 – 6	7 – 13	Full Marks	Abs	Total
Paper A	9	91	166	35	1	302
Paper B	6	60	26	1	15	108

Table 9: The performance of candidates in question 2

Question 3 – Ideograms (16 Marks)

Question 3 dealt with ideograms. Candidates were expected to both recall conventional shapes and colours and come up with specific pictograms to compliment given signs.

In paper 2A many candidates flipped the colours of the safe condition sign using green in the foreground instead of the background. Some even applied various other colours instead of green. The warning sign proved to be less daunting with the majority of candidates colouring it correctly. There were only a few candidates that swapped the yellow and black colours. The third part of the question proved to be the most challenging, with most candidates confusing 'safety goggles' with '3-D cinema glasses', 'covid masks', 'sunglasses', and other unrecognizable drawn objects. Some even went so far as to draw full faces with brown hair and other facial features, ignoring the goggles completely.

The preparatory freehand section proved to be very challenging for candidates. The majority presented repeated sketches, stickmen figures, unrecognisable items, and below standard scribbles instead of properly drawn pictograms. Many also got confused with what shape they should use, and presented their solution inside squares, rectangles, and triangles instead of circles. There were also those who presented circles with two opposite stripes instead of one.

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With regard to the use of colour, some used crayons instead of pencils, applying haphazard dark shades outside the proper sign borders.

In the case of candidates opting for paper 2B, black and white solutions seemed to be more common with some opting to shade entire signs in grey pencil. Other shortcomings with candidates answering this paper were the presentation of partial solutions, prohibition signs left colourless, and presenting just one freehand sketch instead of two in both sections. Some candidates also failed to draw pictograms and presented the information requested in written form.

	0	1 – 7	8 – 15	Full Marks	Abs	Total
Paper A	1	44	247	9	1	302
Paper B	0	14	72	7	15	108

Table 10: The performance of candidates in question 3

Question 4 – Vectors (14 Marks)

The majority of candidates attempted this question, most of whom have demonstrated a good level of understanding of the topic. The most common mistakes featured the:

- a. incorrect direction of the arrow drawn on the resultant;
- b. missing arrow on the resultant;
- c. resultant marked by two arrows instead of one;
- d. incorrect magnitude of the resultant given (many candidates summed up the values of the forces using regular addition);
- e. incorrect angle of the resultant given (many candidates measured the angle between the resultant and the final vector, while they should have measured the angle between the resultant and the horizontal);
- f. vectors drawn as given in the space diagram, that is, not tail to head (however, most of these were still drawn with the correct scale and with the correct angle).

It is advised that candidates pay more attention to the freehand sketch, drawing it completely with the directional arrows on the vectors and the resultant. This will help them out to space their work effectively, whilst aiding their understanding of the problem.

With regard to candidates opting for paper 2B, a considerable number of them did not attempt this question. Amongst those who attempted this question, there were many who just copied the space diagram, and others who also drew the aeroplane. Others drew the vectors with the correct scale and magnitude, but with their angles often incorrect. As in the case with candidates from paper 2A, many measured the resultant's angle relative to other vectors rather than the horizontal.

	0	1 – 6	7 – 13	Full Marks	Abs	Total
Paper A	25	42	191	43	1	302
Paper B	42	21	27	3	15	108

Table 11: The performance of candidates in question 4

Question 5 – Graphs and charts (16 Marks)

Question 5 dealt with the graphical representation of data through a line graph, pie charts and bar graphs. The majority of candidates in both papers 2A and 2B attempted this question with many obtaining high marks.

In both papers, candidates did well in the line graph and the pie chart sections along with the legend and colouring. However, the following errors contributed to reduction of marks:

- the use of pens instead of colour pencils;
- marking the angles incorrectly on the pie chart with the protractor (even though in certain cases the calculations were correct);
- plotting the heights of the 3D bar graphs incorrectly (paper 2A);
- plotting oblique bars even though these were not requested, resulting in lack of precision and neatness (paper 2B).

	0	1 – 7	8 – 15	Full Marks	Abs	Total
Paper A	3	2	257	39	1	302
Paper B	1	11	65	16	15	108

Table 12: The performance of candidates in question 5

Question 6 – Intersection of solids (20 Marks)

Question 6 dealt with intersection of solids, featuring a horizontally oriented prism intersecting a vertically oriented cylinder. In paper 2A, most candidates attempted this question demonstrating different levels of understanding. The majority of candidates found no problems in projecting the end elevation as requested, however they found it quite difficult to construct the developments. The most problematic of these seemed to be the development of the kite prism, with many candidates failing to attempt this part of the question.

Overall, the most notable mistakes were:

- the incorrect matching of intersection points on the end elevation;
- the incorrect matching of cutting points on the development of the cylinder;
- missing edges on the end elevation;
- the use of straight lines when joining the intersection on the end elevation;
- copying the divisions of the development of the prism from those of the development of the cylinder;
- the marking of fold lines or broken lines on the development of the cylinder.

In paper 2B, candidates performed well in drawing the requested end elevation. However, various mistakes were made when drawing the development. These shortcomings varied from taking the wrong measurements in marking the twelve divisions of the width, to marking no divisions at all, and to projecting no horizontal lines to identify the heights of the cut.

When it came to the rendering of the base, there were only a few satisfactory attempts. Most candidates just applied a block brown colour showing no wood grain. Others chose to draw a combination of sporadic lines, some straight some squiggly, that looked nothing like wood. Even though it is not expected from candidates to render materials realistically, they are expected to have some basic knowledge of material texture and colour.

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	0	1 – 8	9 – 19	Full Marks	Abs	Total
Paper A	5	142	147	7	1	302
Paper B	5	66	22	0	15	108

Table 13: The performance of candidates in question 6

Question 7 – Isometric drawing (10 Marks)

This question dealt with isometric drawing. Candidates had to obtain the information about the object to be drawn, including its measurements, from the given orthographic views. They were expected to initially draw a freehand sketch to orient themselves around the proper shape of the object and then proceed to construct the object using their instruments and following the principles of isometric drawing.

Similar issues of concern were observed in both papers 2A and 2B. When it came to freehand drawing it was plain clear that most candidates lack sound freehand knowledge skills. Very few candidates used a wireframe crate to help them scale the object properly, with many going outside the boundaries of the available space.

Another point to mention is the difficulty most candidates find in visualizing pictorial views from two-dimensional drawings. This indicates that more work needs to be done to aid candidates develop their spatial ability skills.

When it came to the construction of the isometric circle, many candidates found no difficulty in applying the method of construction for the top part of the isometric hole, however difficulties were encountered when they came to project its thickness.

Another issue of concern dealt with the positioning of the block. Certain candidates ignored the instruction of where the center marked X was to be placed, resulting in wrongly rotated pictorials. This in turn caused part of the block to be hidden or else to overlap the drawing space. Particularly with regard to candidates answering paper 2B, only a few managed to complete the drawing successfully, with some even having problems remembering that they had to orient their block at a 30-degree angle.

	0	1 – 4	5 – 9	Full Marks	Abs	Total
Paper A	16	80	201	4	1	302
Paper B	9	61	21	2	15	108

Table 14: The performance of candidates in question 7

Chairperson
Examination panel 2022