![L-Università ta' Malta logo]

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2022 SECOND SESSION

SUBJECT:	**Engineering Drawing/Graphical Communication**
PAPER NUMBER:	I
DATE:	29th August 2022
TIME:	9:00 a.m. to 12:05 p.m.

Directions to Candidates

Write your index number where indicated at the top of all drawing sheets.

Attempt any **FIVE** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

a.   drawings should conform to B.S. or equivalent (ISO) standards;
b.   all dimensions are in millimetres;
c.   all answers are to be accurately drawn with instruments;
d.   all construction lines must be left in each solution;
e.   drawing aids may be used.

Dimensions not given should be estimated.

Careful layout and presentation are important.

Marks will be awarded for accuracy, clarity and appropriateness of constructions.

Question 1.

An illustration of a pentagonal pyramid cut by an oblique plane is given in Figure 1a.

Two orthographic views and the traces of the oblique plane (VT, HT) cutting the pyramid are given in Figure 1b.

You are requested to:
a) copy the views given in Figure 1b; (2)
b) project an auxiliary view of the pyramid, showing the oblique plane as an inclined cutting plane; (6)
c) project the plan of the pyramid with the part above the cutting plane removed; (3)
d) project the truncated front elevation; (4)
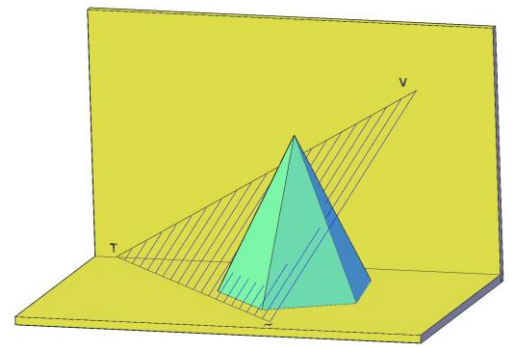e) project the true shape of cut. (5)

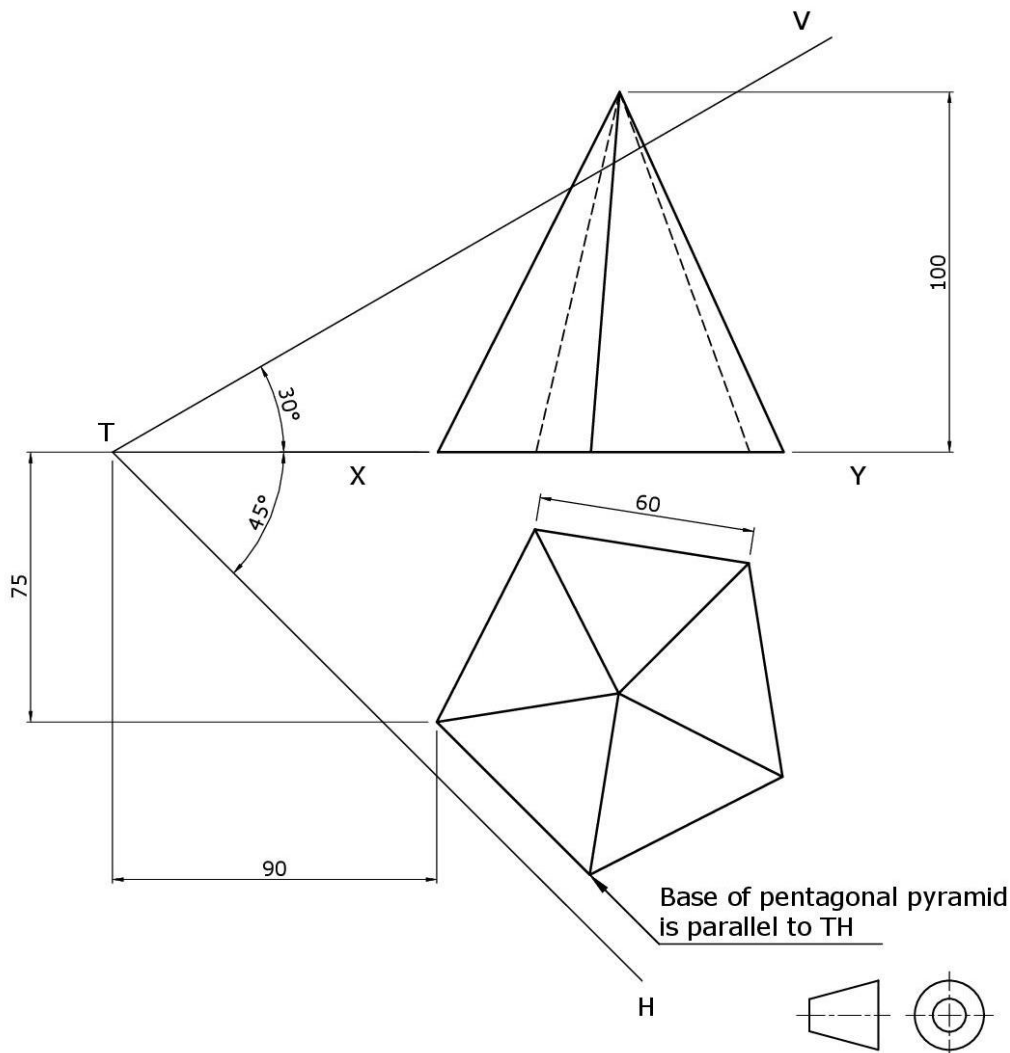**(Total: 20 marks)**

Figure 1a

Figure 1b

Question 2.

An illustration of a ducting arrangement is shown in Figure 2a.
The transition piece (square to round elbow) connects the square duct to the cylindrical duct, set at right angle to each other.
You are requested to:
a) copy Figure 2b;   (2)
b) construct the necessary true lengths;   (7)
c) construct a half surface development of the transition piece, placing the seam lines at W1 and Z7.   (11)
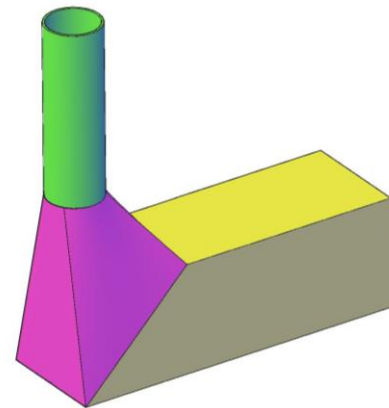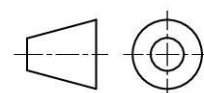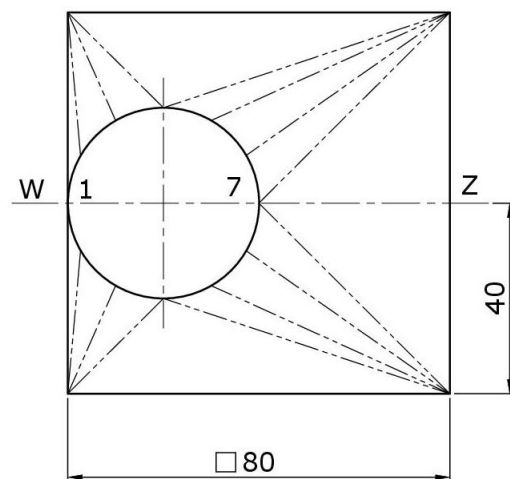
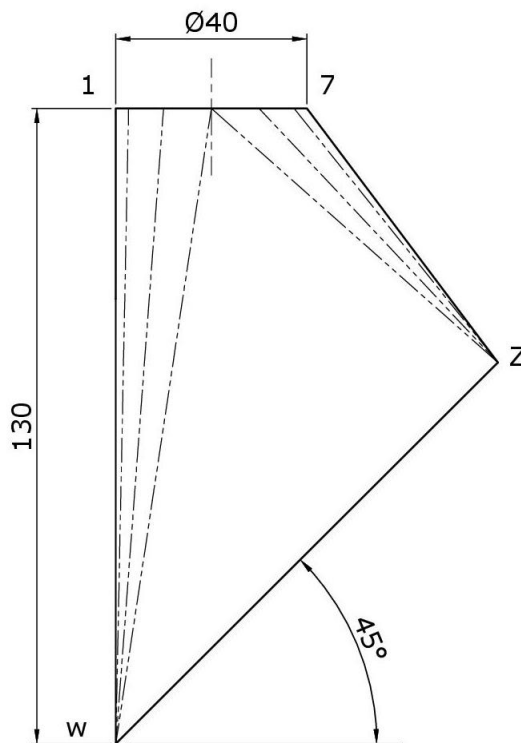**(Total: 20 marks)**

Figure 2a

Figure 2b

Please turn the page.

Question 3.

Three orthographic views of a machined component are given in Figure 3.
You are requested to:
a) copy the given views; (4)
b) draw a small preparatory isometric sketch of the component, placing corner X of the isometric crate in the lowermost position; (2)
c) draw a full-size isometric view of the machined component. (14)

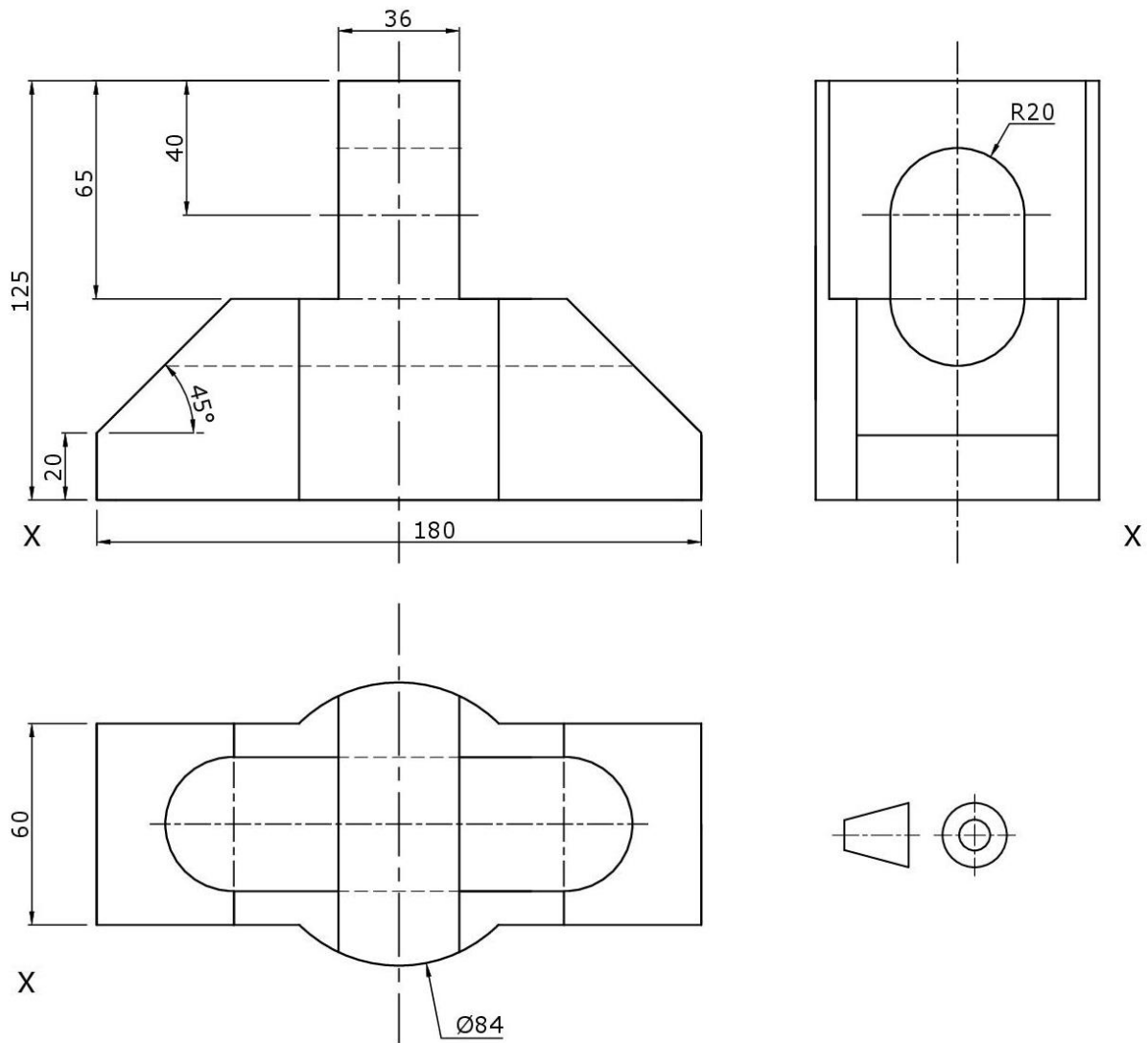Note: Careful spacing is recommended.

(Total: 20 marks)

Figure 3

Question 4.

Figure 4a shows the logo of a new paragliding club.
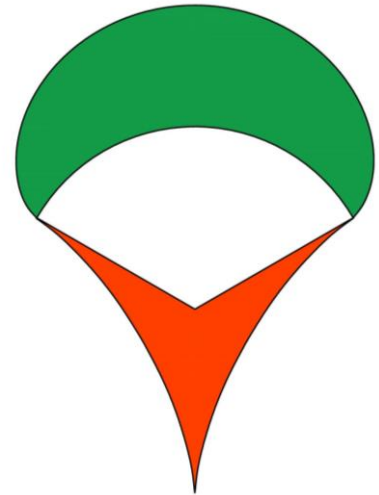Figure 4b shows the starting lines of the logo which is to be constructed as follows:

- The top curve is to be generated by point P on the Ø60 circle 'A' which rolls clockwise without slipping for one revolution on the Ø180 directing circle.
- The lower right-hand side curve is to be generated by point Q on the Ø60 circle 'B' which rolls clockwise for one revolution without slipping inside the Ø180 directing circle.

You are requested to:
a) copy Figure 4b;   (3)
b) construct the locus of point P;   (6)
c) name the generated curve;   (1)
d) construct the locus of point Q;   (6)
e) name the generated curve;   (1)
f) reflect the curve generated by point Q;   (2)
g) complete the logo by keeping elements of the initial constructions given in Figure 4b.   (1)

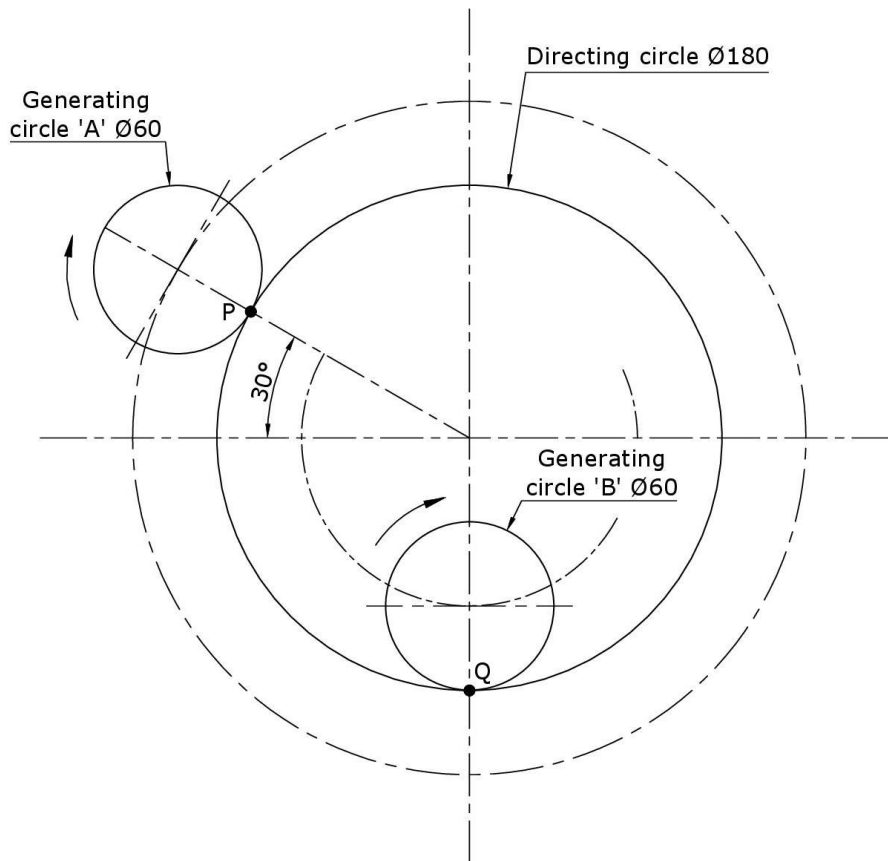Figure 4a

(Total: 20 marks)

Figure 4b

Please turn the page.

Question 5.

Figure 5a shows an illustration of a conical container intersected by a cylindrical spout. Figure 5b shows two incomplete orthographic views of the vessel.
You are requested to:
a) copy the elevation and plan given in Figure 5b;   (2)
b) determine, by construction, the curve of intersection between the cone and the cylinder;   (8)
c) project the curve of intersection and the horizontal section plane to the plan;   (4)
d) construct the surface development of the cone including the hole resulting from the intersection with the cylinder.   (6)
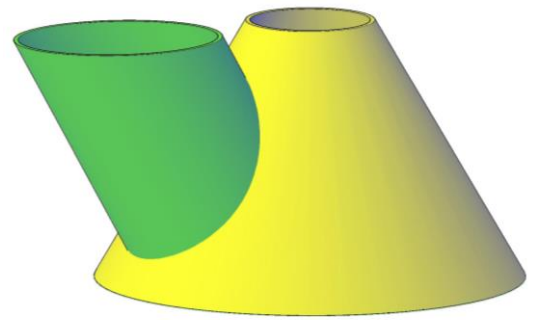
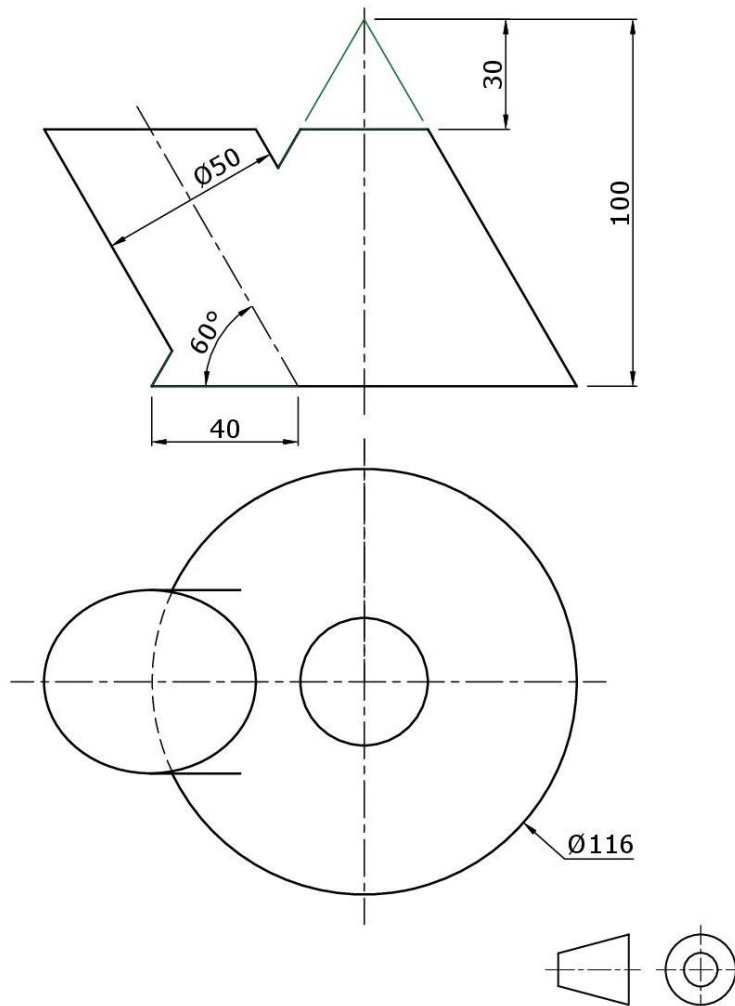**(Total: 20 marks)**

Figure 5a

Figure 5b

Question 6.

Two orthographic views of a machined component are shown in Figure 6. The shaded areas in both views indicate an oblique cut.
You are requested to:
a) copy the given views; (2)
b) project a first auxiliary elevation from the direction of arrow 'S'; (8)
c) project a second auxiliary view of the whole component to show the true shape of the shaded area. (10)
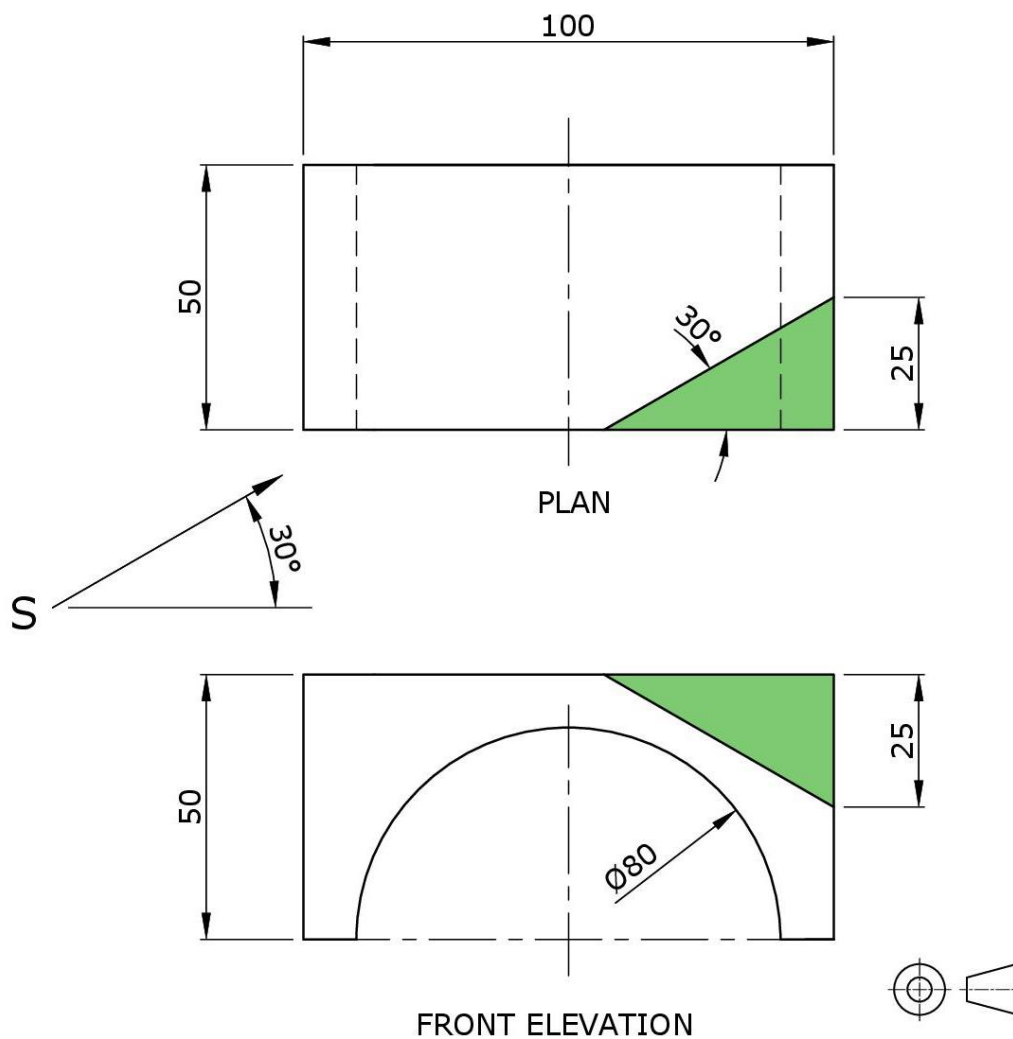Note: Do **not** show hidden detail.

(Total: 20 marks)

Figure 6

Please turn the page.

Question 7.

The simply supported beam, shown in Figure 7, carries a combination of point loads and a udl.
You are requested to:
a) copy the given space diagram using a scale of 20 mm representing 1 m; (2)
b) label the diagram by using the Bow's notation; (1)
c) draw the load line using a vector diagram scale of 10 mm representing 10 kN; (4)
d) draw the polar diagram using a polar distance of 120 mm; (1)
e) draw the bending moment diagram; (5)
f) draw the shear force diagram; (3)
g) determine graphically the values of R_L and R_R; (2)
h) determine the magnitude, nature, and position of the greatest bending moment. (2)
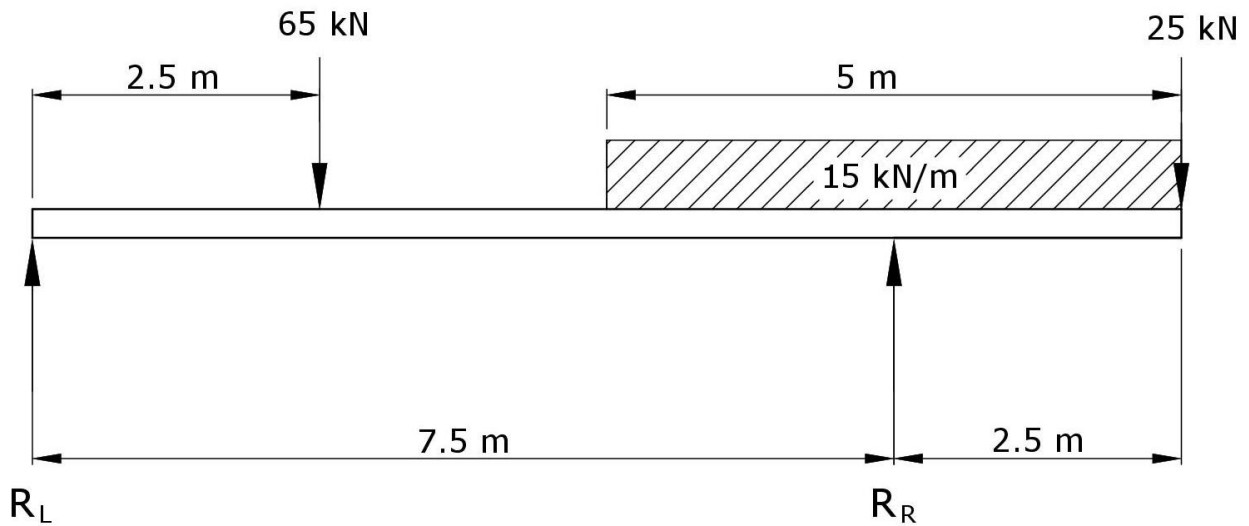
(Total: 20 marks)

Figure 7

Question 8.

Figure 8 shows the starting lines of an offset disc cam. The centre line of the roller ended follower is offset 20 mm to the right of the cam axis. The cam rotates anticlockwise, and its minimum radius is 34 mm. The following is the displacement and motion data:

Cam rotation	Follower movement and type of motion
0°- 120°	Follower to rise 40 mm with uniform acceleration and retardation.
120°- 210°	Follower to rise 30 mm with uniform velocity.
210°- 240°	Dwell
240°- 360°	Follower to fall 70 mm with simple harmonic motion

You are requested to:
a) copy, in the proper place, the drawing given in Figure 8;   (2)
b) construct the follower displacement diagram;   (8)
c) construct the cam profile.   (10)
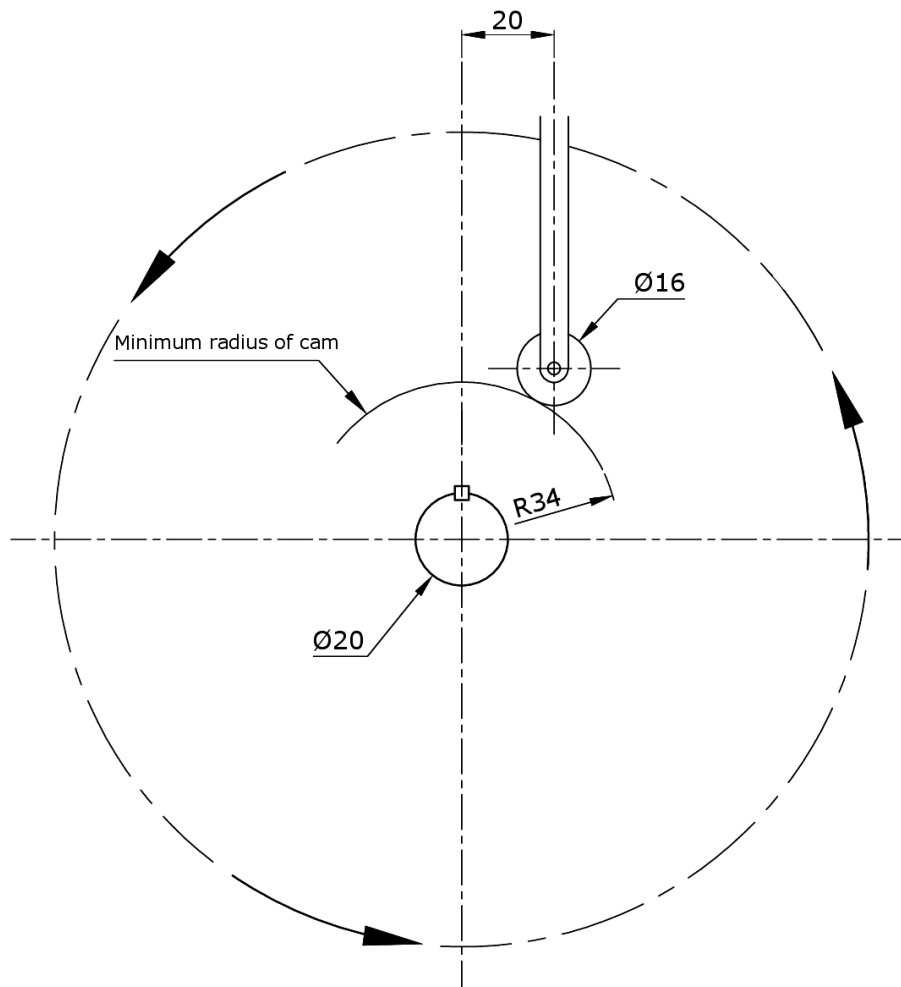
(Total: 20 marks)

Figure 8

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SUBJECT:	**Graphical Communication**
PAPER NUMBER:	II
DATE:	30th August 2022
TIME:	9:00 a.m. to 12:05 p.m.

Directions to Candidates

Write your index number where indicated at the top of all drawing sheets.

Attempt question 1 and any other **THREE** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

a.   drawings should conform to B.S. or equivalent (ISO) standards;
b.   all dimensions are in millimetres;
c.   answers are to be accurately drawn with instruments;
d.   all construction lines must be left on each solution;
e.   drawing aids may be used.

Dimensions not given should be estimated.

Careful layout and presentation are important.

Marks will be awarded for accuracy, clarity and appropriateness of constructions.

Colour/shading should be used where appropriate.

Mark allocations are shown in brackets.

Question 1 carries 34 marks. Questions 2, 3, 4 and 5 carry 22 marks **each**.

Question 1.

Figure 1a shows three orthographic views of a small city bar. These orthographic views show the proportion of every element within the bar. Use this information to draw a two-point estimated perspective of the bar. The arrows on the plan indicate the viewing direction.

a) Using **THREE** preliminary sketches, explore alternative positions of the horizon line and identify the one which, in your opinion, best describes the spaciousness of the entire area.   (3)

b) Based on the choice made in part (a), use a suitable scale to produce the required illustration on a single side of an A2 size paper, making the best use of the space available.   (26)

c) Enhance your drawing by colouring small areas of the different items appearing in your illustration.   (5)

   Notes:

   - The tables, stools and shelving are made of timber.
   - The counter is made of stainless steel.
   - The sofa and the lampshades are made of red textile.
   - Details of a table and a seat are given in Figure 1b.
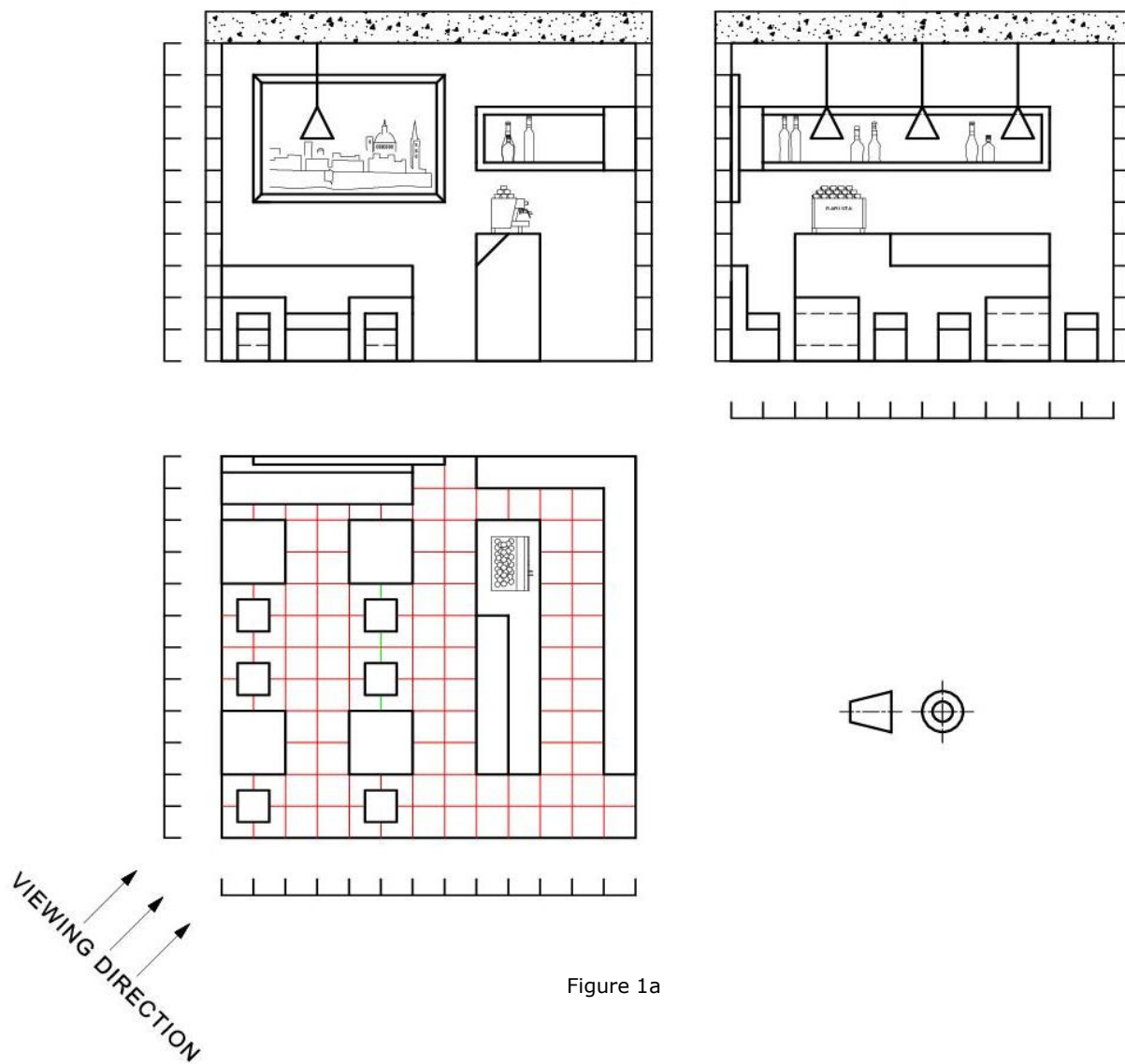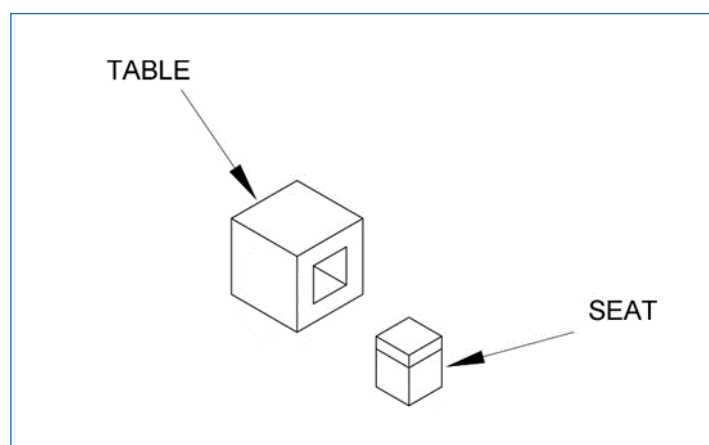
(Total: 34 marks)

VIEWING DIRECTION

Figure 1a

TABLE

SEAT

Figure 1b

Please turn the page.

Question 2.

A survey on the use and preference of mobile applications was conducted among a group of teenagers. The results are featured in the following incomplete table (Figure 2):

RANK	TYPE OF APP	APP ICON	VOTES
1	Music		95
2	Chat		80
3	Photos		60
4	Sports		50
5	Drawing		45
6	E-Books		35
7	Weather		25
8	Maths		15
9	Maps		10

Figure 2

a) You are required to draw an infographic chart displaying the information above. The chart should contain text, at least **ONE** graph, and **ONE** icon for **each** of the nine applications. The title of this chart should be 'MOBILE APPLICATION PREFERENCE'. (10)

b) Use suitable typefaces to show **all** written information. In a separate section within the same A2 sheet, provide preparatory sketches for the missing icons. (10)

Note: The application icons for music, drawing, weather, and maths have been given and need only to be copied, while the others need to be designed by yourself.

(Total: 22 marks)

Question 3.

Figure 3a shows the facade of a new pet shop that is about to open in town by the name of PETS' GALAXY. Its owner needs an eye-catching sign to put over the entrance of this shop.

Produce this sign, which needs to include both the name of the pet shop and suitable graphics associated with pet care.

You need to present your work broken down according to the following steps and as shown in Figure 3b below.
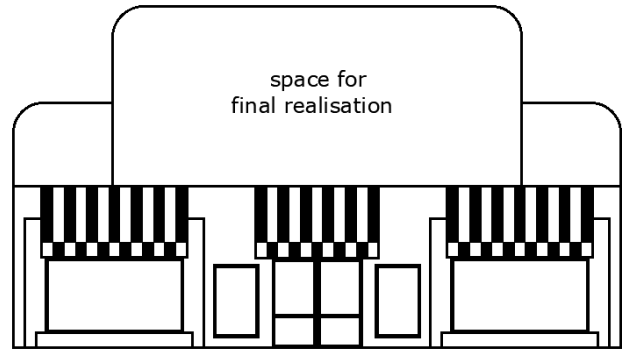

Figure 3a

a) Written analysis
   Identify, using keywords/short phrases the
   main parameters of the design brief. (2)

b) Graphical analysis
   Based on your response to the written analysis, produce a series of preparatory sketches that illustrate your developing ideas. (4)

c) Design synthesis
   Clearly identify those elements present in your sketches that you intend to use in your final design. (2)

d) Final realisation
   Use colour and shading to produce your final realisation in a rectangle as shown in Figure 3b.

(14)

   Notes:
   • Use suitable typefaces for your design.
   • Details of the page layout and the design space are given in Figure 3 below.
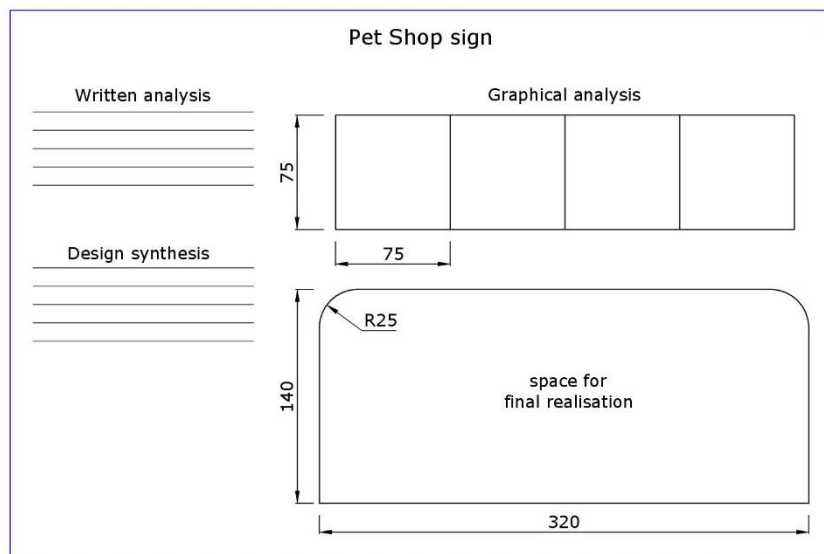
(Total: 22 marks)

Figure 3b

Please turn the page.

Question 4.

Figure 4 shows three orthographic views of a plastic toy plane.

You are requested to:

a) make a well-proportioned pictorial (3D) freehand drawing of this plane; (14)

b) colour and shade your drawing using the following instructions: (8)
   - main body - yellow
   - wings - green
   - wheels - red
   - propeller - red
   - spinner (nose) - blue
   - rudder (vertical director on back) - blue
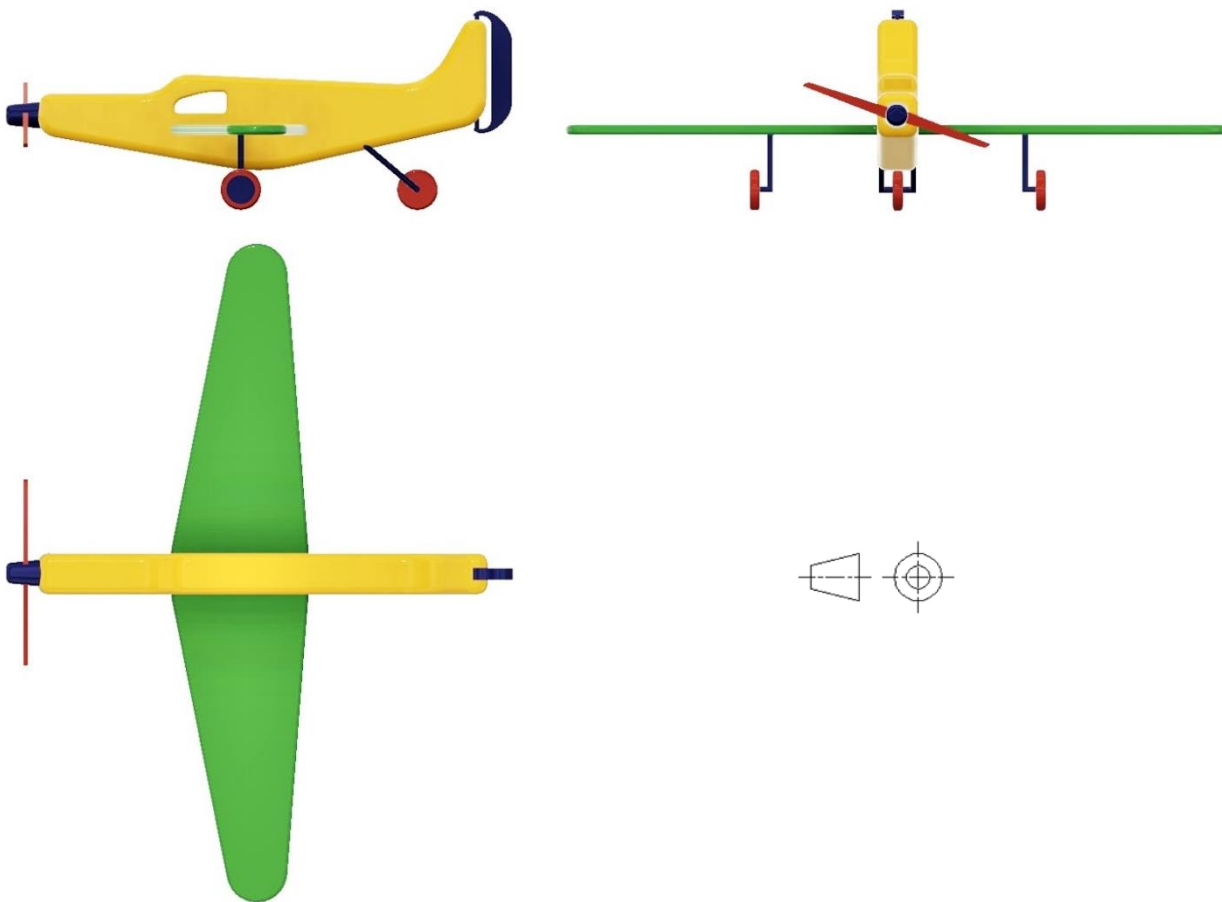   - shock struts (wheel arms) - blue

(Total: 22 marks)

Figure 4

Question 5.

Figure 5 shows a three-dimensional line sketch of a bench vice. The vice has two parallel jaws, one fixed and the other movable. A threaded screw is rotated by means of a handle to open or close the distance between the jaws.

You are requested to:

a) draw a two-dimensional freehand sketch of this bench vice as seen when looking from the direction of arrow F; (12)

b) render your sketch to show the volume of the bench vice. (10)

Notes:

- The fixed jaw and base are made of cast iron painted with hammered paint.
- The sliding jaw is also painted with hammered paint.
- The anvil, handle and screw are made of machined steel.
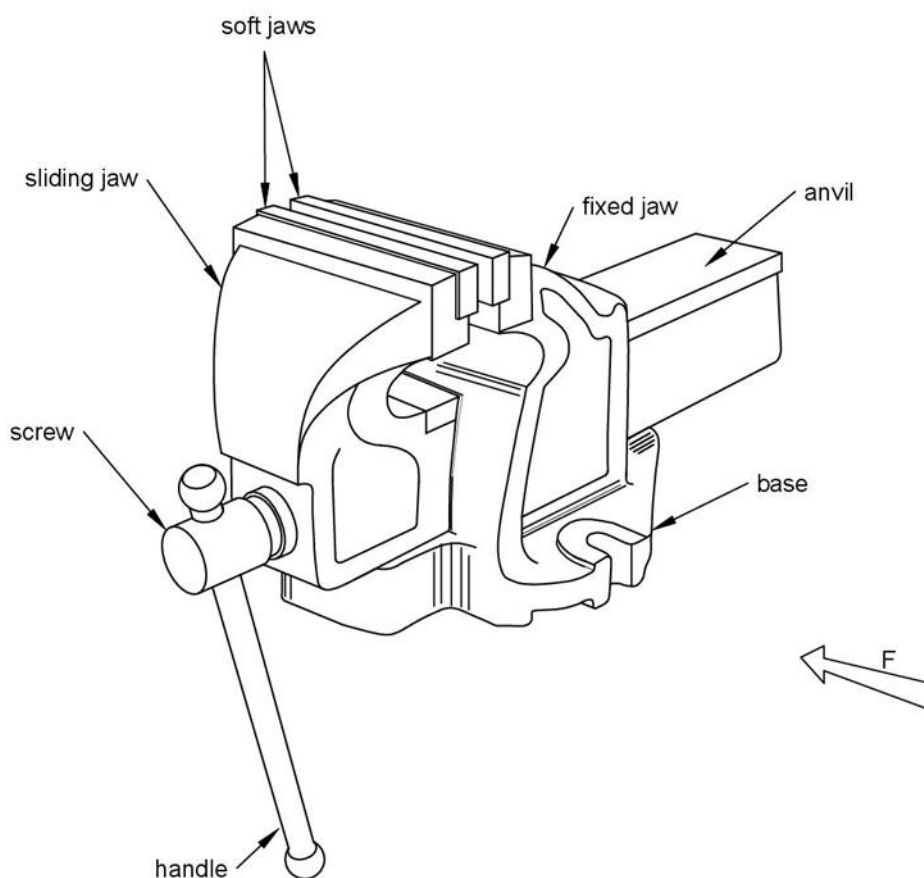- The soft jaws are made of copper.

(Total: 22 marks)

Figure 5