MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**INTERMEDIATE MATRICULATION LEVEL
2024 FIRST SESSION**

L-Università
ta' Malta

SUBJECT:	**Engineering Drawing and Graphical Communication**
DATE:	29th May 2024
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.

Only scientific calculators may be used. Programmable calculators are not allowed.

Unless otherwise stated:

a. B.S. or equivalent (ISO) recommendations should be adopted throughout your answers;
b. all dimensions are in millimetres, unless otherwise stated;
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.

Colour/shading may be used where appropriate.

Section A: Attempt any **FOUR** questions from five.

Section B: Attempt any **ONE** question from two.

Section C: Attempt any **ONE** question from two.

SECTION A

Attempt any **FOUR** questions from this section.

Question 1

The space diagram of five coplanar non-concurrent forces acting on a square block ABCD are shown in Figure 1. The magnitude, direction, and location of the equilibrant are required.

a. To a scale of 40 mm representing 1 m, draw the given space diagram.   (1)
b. To a scale of 10 mm representing 1 kN, draw the force diagram.   (5)
c. Measure and state the magnitude and angle of the equilibrant, clearly indicating its sense.   (1)
d. Draw a polar diagram to determine the position of the equilibrant force.   (4)
e. Locate the equilibrant force in the space diagram.   (1)
f. Measure and state the shortest distance of the equilibrant from corner A.   (1)
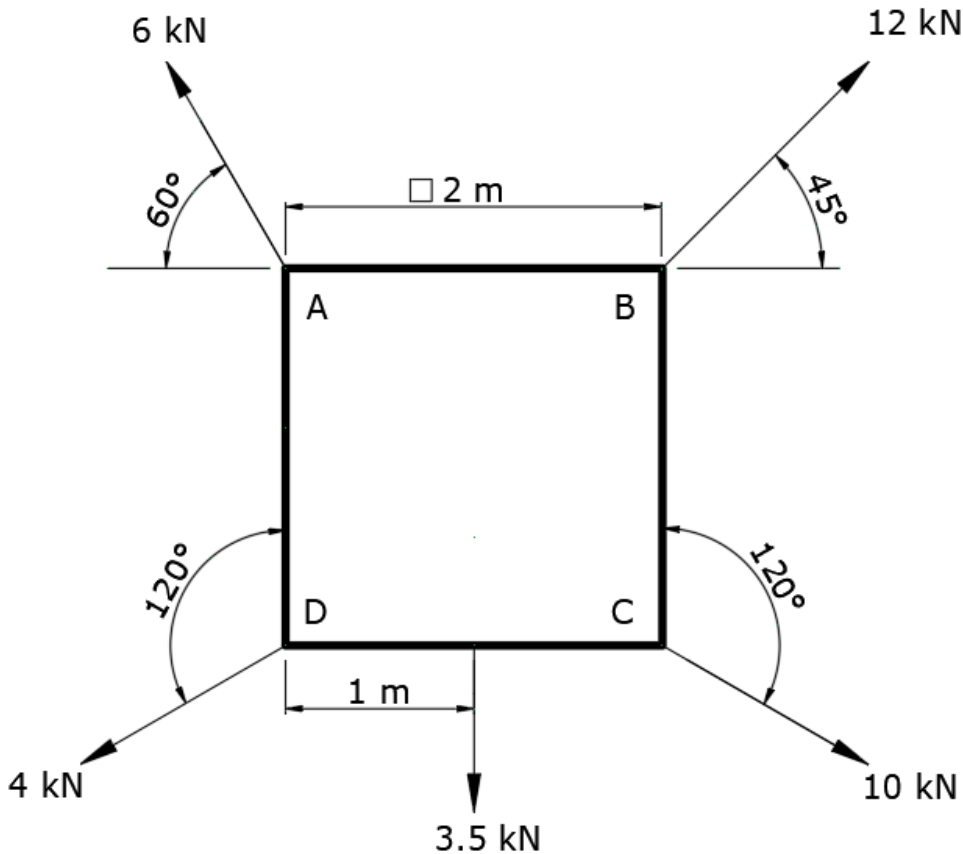
(Total: 13 marks)

6 kN   12 kN

60°   2 m   45°

A   B

120°   120°

D   1 m   C

4 kN   10 kN

3.5 kN

Figure 1

Question 2

An illustration of an oval-flat to hexagon transition piece is shown in Figure 2a. Two orthographic views of the transition piece are given in Figure 2b.
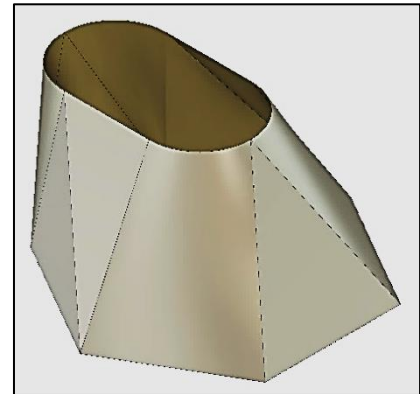
a. Draw full size the front elevation and the plan. (2)
b. Triangulate the surface of the transition piece in both views. (2)
c. Label the top and bottom points and find the required true lengths. (2)
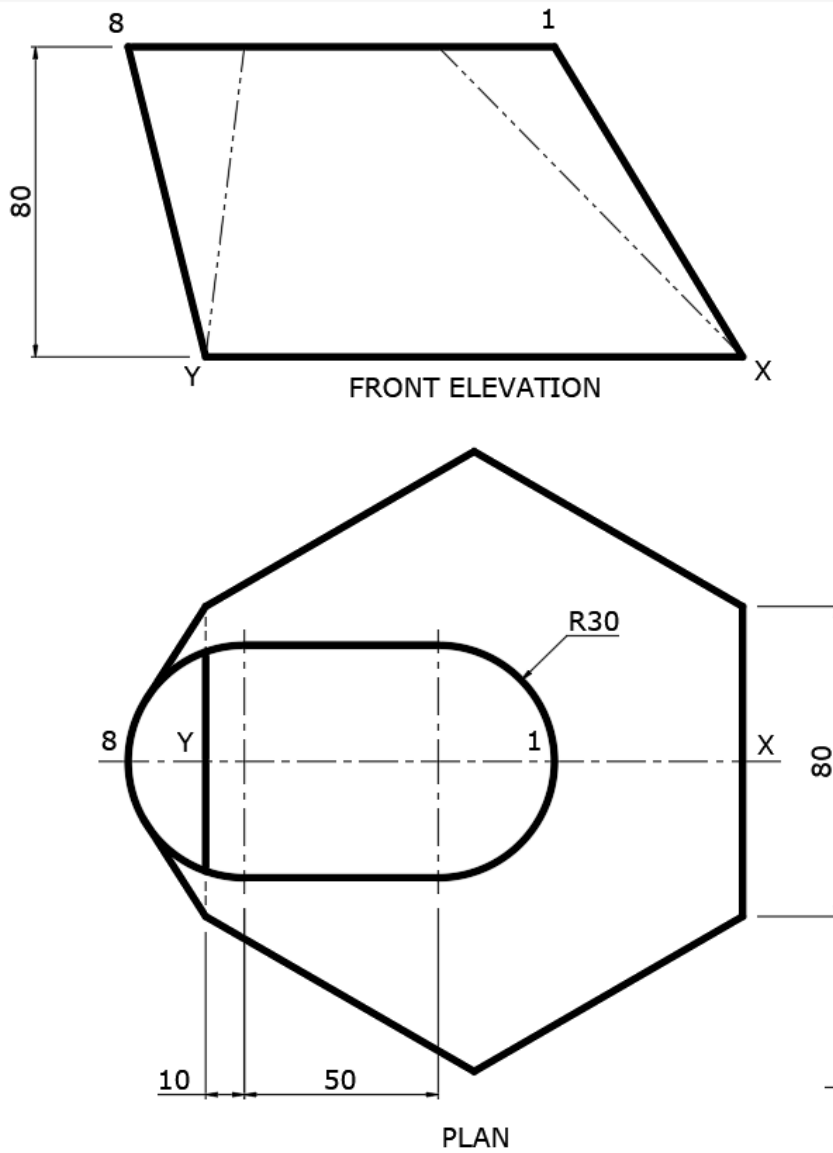d. Construct a half surface development along seam lines X1 and Y8. (7)

(Total: 13 marks)

Figure 2a

FRONT ELEVATION

8   1

80

Y   X

R30

8   Y   1   X

80

10   50

PLAN

Figure 2b

Please turn the page.

Question 3

Figure 3 shows two orthographic views of a plastic component. A scaled isometric projection is required.

a. Construct an isometric scale to measure up to 190 mm. (2)
b. Use the scale to draw an isometric view of the component. (11)

Notes:

*   Position corner X at the lowest point of your drawing.
*   Hidden details are not required.
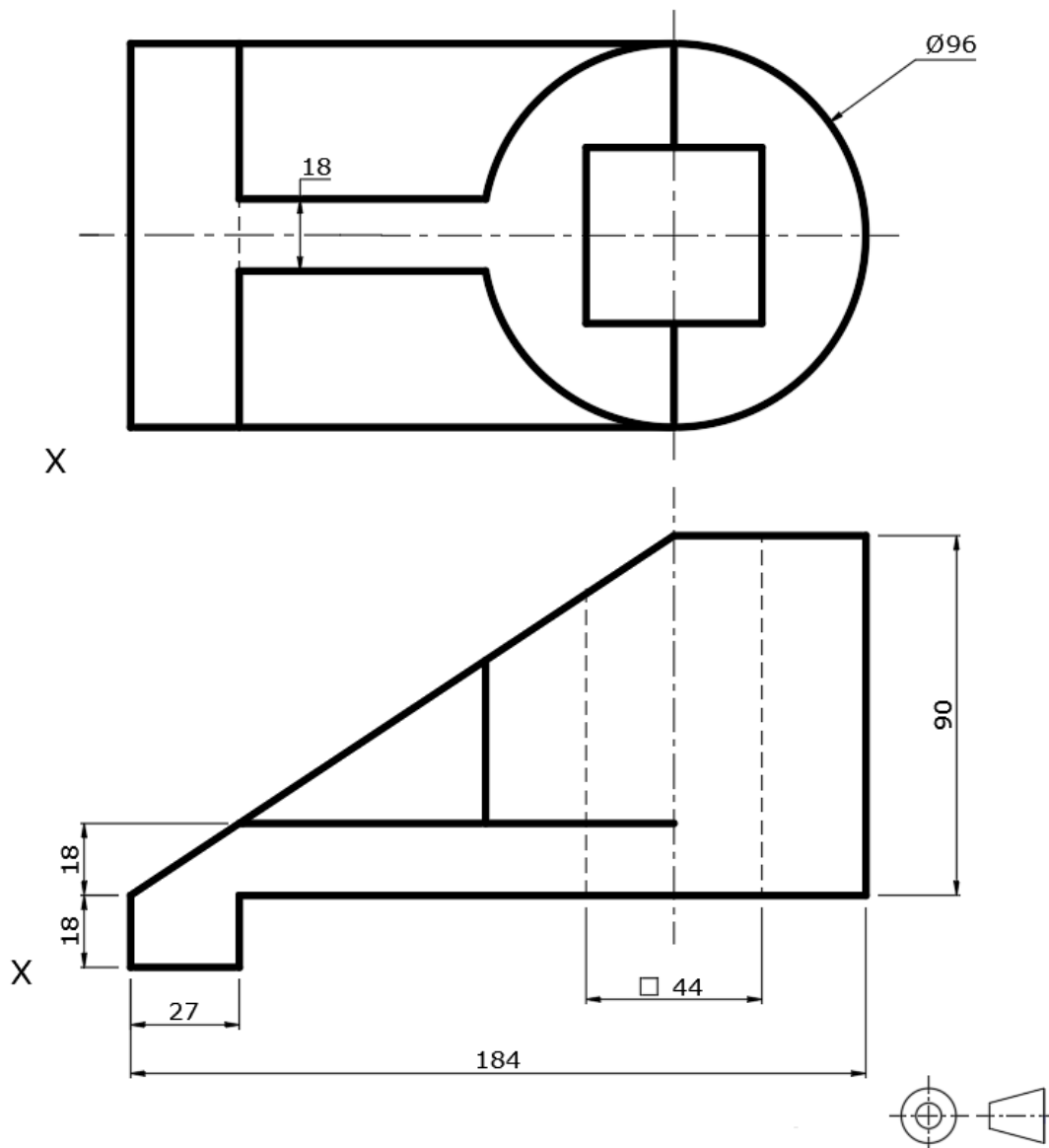
(Total: 13 marks)

Figure 3

Question 4

Figure 4a illustrates a ceiling reflector consisting of a conical case held by means of a pentagonal hollow prism. An incomplete front elevation and an auxiliary plan of the assembly are given in Figure 4b.
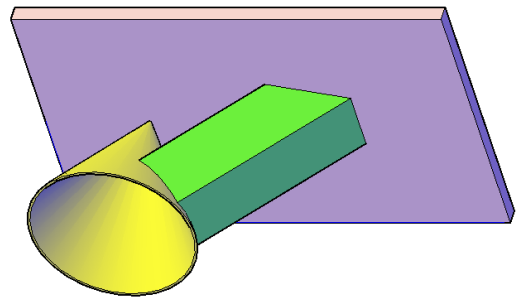
a. Copy the given views. (4)
b. Construct the curves of intersection in the front elevation. (5)
c. Project the complete plan. (4)

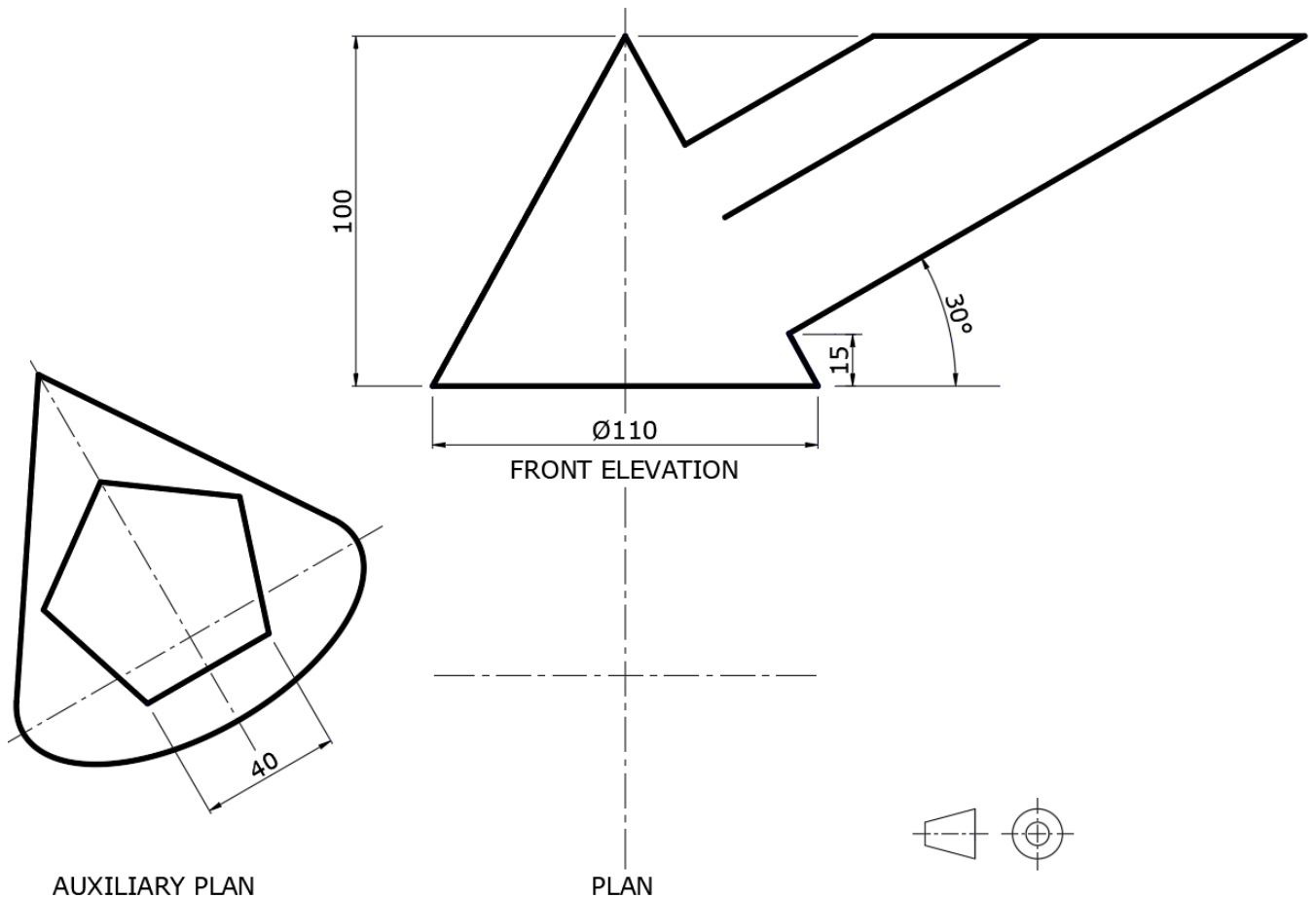 Note: Show hidden detail in the plan view.

(Total: 13 marks)

Figure 4a

FRONT ELEVATION

Ø110

100

15

30°

AUXILIARY PLAN

40

PLAN

Figure 4b

Please turn the page.

Question 5

A satellite communication poster is shown in Figure 5a. The poster consists mainly of two conic sections. A parabola representing the transmitter and an ellipse to represent satellite orbit. Figure 5b shows the layout of the starting lines of the two conics.
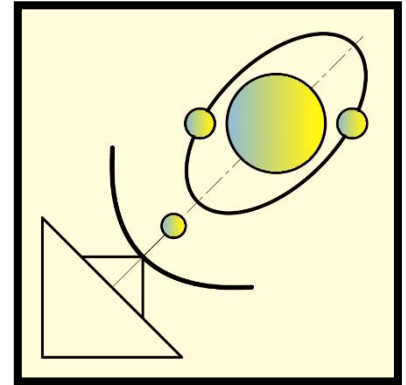
a. Copy full size the rectangle and the transverse axis of the ellipse. (1)
b. Construct a parabola inside the rectangle PQRS. (4)
c. Locate, by construction, the focal point and the directrix of the parabola. (1)
d. Using an eccentricity of 5:6, locate the position of the vertex of the ellipse. (1)
e. Construct the ellipse by using the locus of a point method. (5)
f. Complete the geometry of the poster. (1)

Figure 5a

Note:
* As indicated in Figure 5b, the upper side of the rectangle is also the directrix of the ellipse.
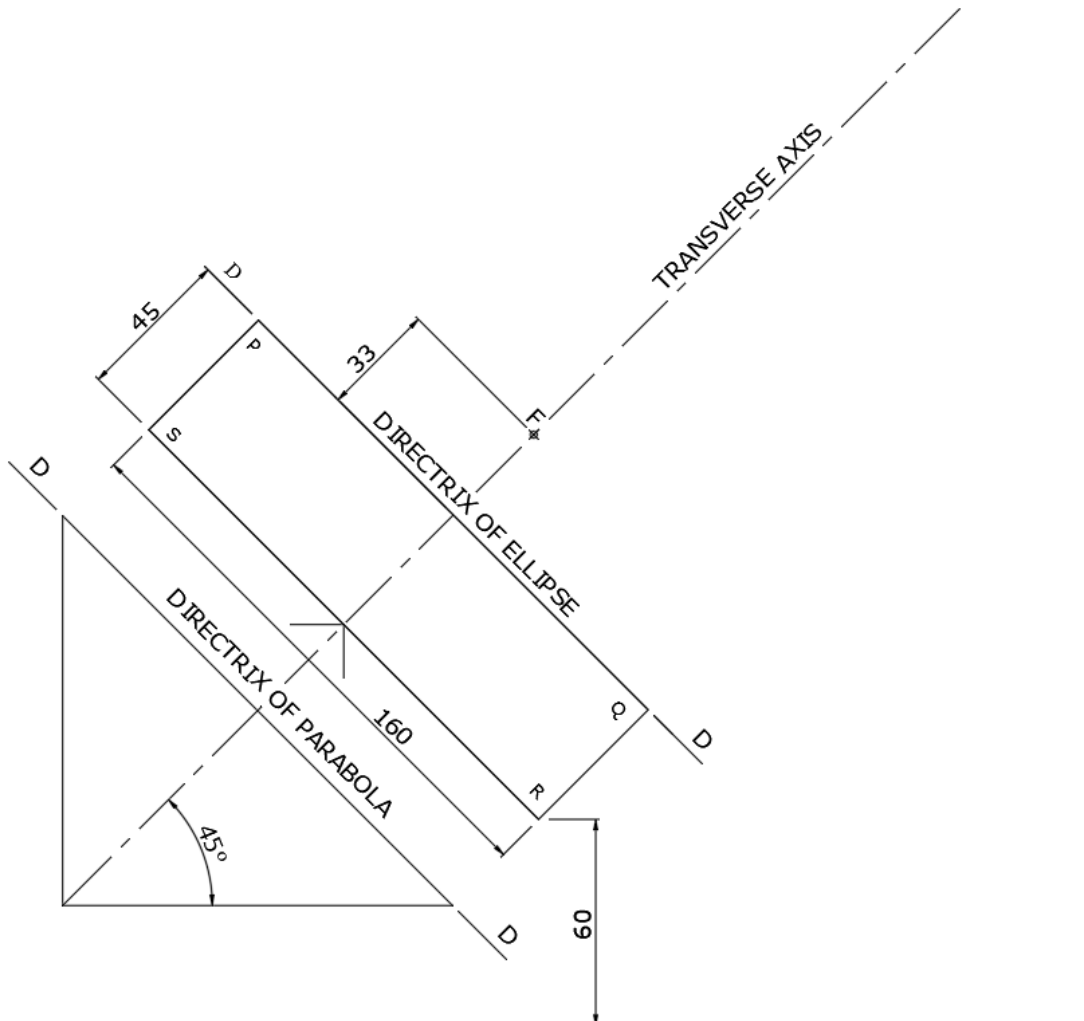* The dimensions of the spheres are to be estimated.

(Total: 13 marks)

Figure 5b

SECTION B

Attempt only **ONE** question from this section.

Question 6

An exploded three-dimensional view of a Plummer block is shown in Figure 6a. Detail drawings are given in Figure 6b on the A3 paper attached. The Plummer block is assembled as follows:

- The bottom brass (Item 4) is fitted inside the base (Item 1) using the Ø6 snug for alignment.
- The top brass (Item 3) is placed on top of the bottom brass and held in place by the cap (Item 2).
- The two partially threaded M12 bolts (Item 5) fit inside the Ø12 holes in the base and through the Ø12 holes in the cap. The hexagonal bolt heads fit inside the rectangular recess in the base and are held in place at the cap end by the washers (Item 7) and the M12 nuts (Item 6).
- The Ø50 shaft (Item 8) is inserted inside the Ø50 split brass bush.

Draw, full size, in first angle orthographic projection the following views of the assembled Plummer Block:
a) A half-sectional front elevation on the cutting plane X-X.   (14)
b) A plan showing cutting plane X-X.   (10)

Notes:
- Place the face of the shaft 20 mm outside the brasses in the plan view.
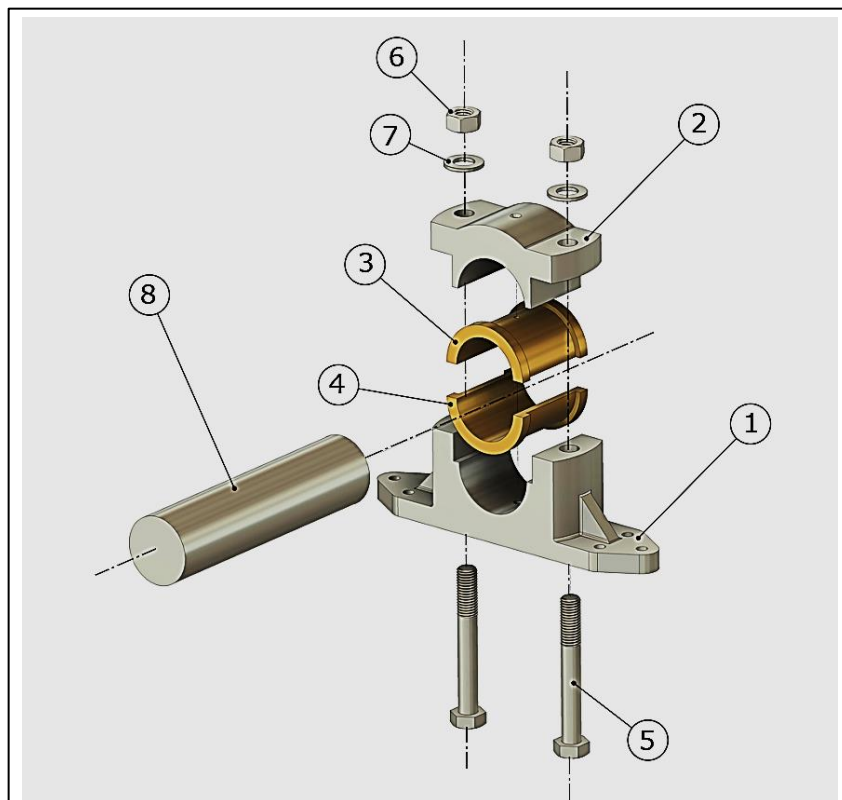- Hidden detail is not required.

(Total: 24 marks)

Figure 6a

Please turn the page.

Question 7

An exploded three-dimensional view of a turnbuckle is shown in Figure 7a. Detail drawings of the parts of the turnbuckle are given in Figure 7b on the A3 paper attached. The turnbuckle, which is commonly used to adjust tension in ropes or steel wires, is assembled as follows:

- The hook end (Item 2), consisting of a steel rod with a hook at one end and an M15 x 1.5 right-hand vee thread at the other end, is screwed into the right end threaded hole in the main body (Item 1).
- The jaw end (Item 3), consisting of a steel rod with a U-shaped jaw at one end and an M15 x 1.5 left-hand vee thread at the other end, is screwed into the left side of the main body.
- The M12 bolt (Item 4) goes through the hole in the jaw end, and it is kept in place by an M12 nut (Item 5).

Draw, full size, in first angle orthographic projection the following views of the assembled turnbuckle:
a) A plan (including cutting plane X-X). (9)
b) A sectional front elevation on the cutting plane X-X. (12)
c) A 5:1 detail of the left-hand vee-thread of the jaw end, drawn in conventional mode (use straight lines instead of the helical construction). Draw two turns and indicate clearly that the detail is an enlargement of the thread by labelling it as Detail 'D' (see Item 3). Also ensure the correct inclination of the left-hand thread. (3)

Note:
In the assembly drawing, keep a distance of 10 mm between the threaded ends of the hook and the jaw ends.
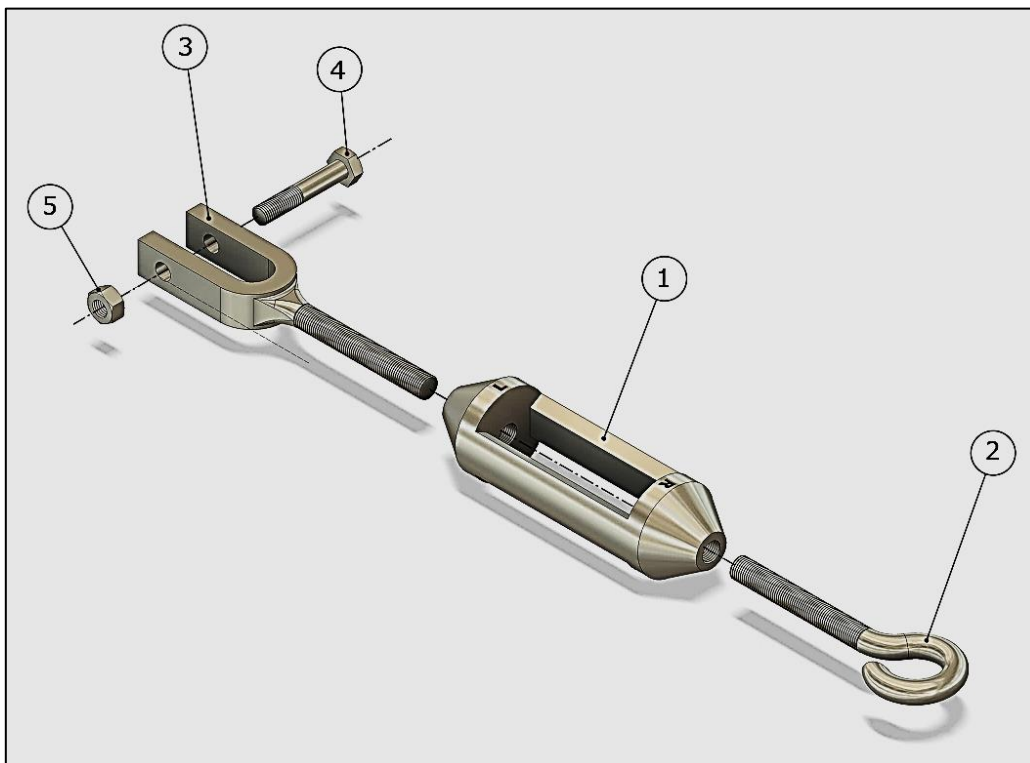
(Total: 24 marks)

Figure 7a

SECTION C

Attempt only **ONE** question from this section.

Question 8

To promote teamwork, the school management team decided to organize a burger preparation day. They decided to call this activity Burger Bash. Preceding the event, they needed to commission a pictorial chart to be displayed in the school corridor.
Design a pictorial chart as required. Your presentation must follow the steps given below.

a)   Prepare **TWO** annotated preparatory sketches to illustrate your developing ideas regarding the layout and presentation of the chart.   (2)
b)   Label the chart with the heading "BURGER BASH".   (2)
c)   Draw pictorial illustrations to depict each of the following 8 stages:

   1)   Cut a burger bun into two equal parts horizontally.
   2)   Add ketchup to the bottom half bun.
   3)   Place a crisp lettuce leaf to add freshness and crunch.
   4)   Add slices of fresh tomato to add juiciness.
   5)   Place the cooked beef burger patty on top of the tomato slices.
   6)   Season the patty with salt and pepper.
   7)   Add a slice of cheese on top of the seasoned hot patty. The heat from the patty will melt the cheese.
   8)   Finish with the top half bun ready to be served.   (16)

d)   Include a pictorial pie chart to show the percentage of calories of one beef burger, coming from carbohydrates, fats, and protein, using the information from the Nutrition Information table below: (4)

Nutrition Information	
	Percentage of Calories
Total Carbohydrates	39%
Total Fats	28%
Protein	33%

Note: Special consideration is to be given to the following:
   i.   the use of colour and shading to render the chart;
   ii.   the use of appropriate typography (fonts);
   iii. the formation of an attractive presentation, clearly conveying the information.

(Total: 24 marks)

Please turn the page.

Question 9

A pictorial illustration of a small patio dining area is shown in Figure 9a, whilst an orthographic projection of the dining area is shown in Figure 9b. The area is furnished with two identical wooden benches, a wooden cross-legged table, and a shelf service window.

a) Use the dimensions given in the orthographic projection to construct an estimated two-point perspective drawing of the dining area. The viewing direction required is indicated by the arrows in the plan. (21)

b) Partially render your drawing to illustrate the colour and texture of the main elements in the outdoor dining area. (3)

Note: Use the layout of the two-point perspective shown in Figure 9c.

Figure 9a

(Total: 24 marks)

PLAN

Viewing
direction

220

240

FRONT VIEW

200

END VIEW

Figure 9b

V.P₁

V.P₂

UNIVERSITY OF MALTA

QUESTION No.	SESSION:	SCALE:
	DATE:	
	PAPER No:	SHEET OF
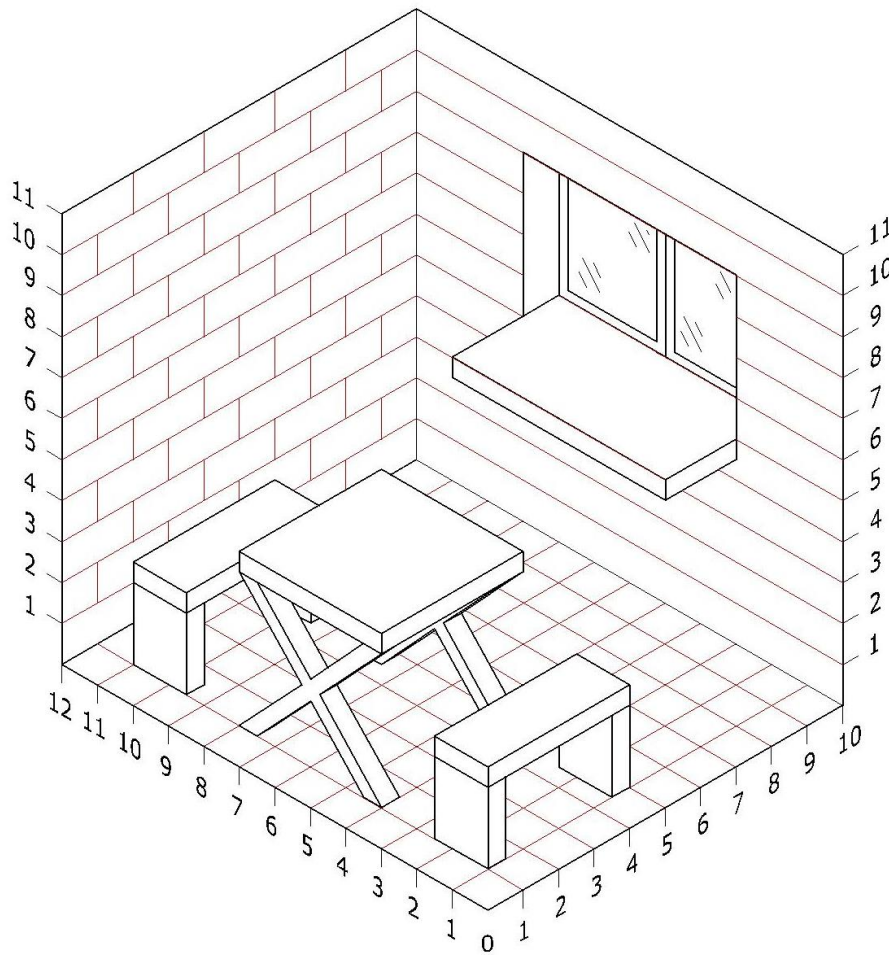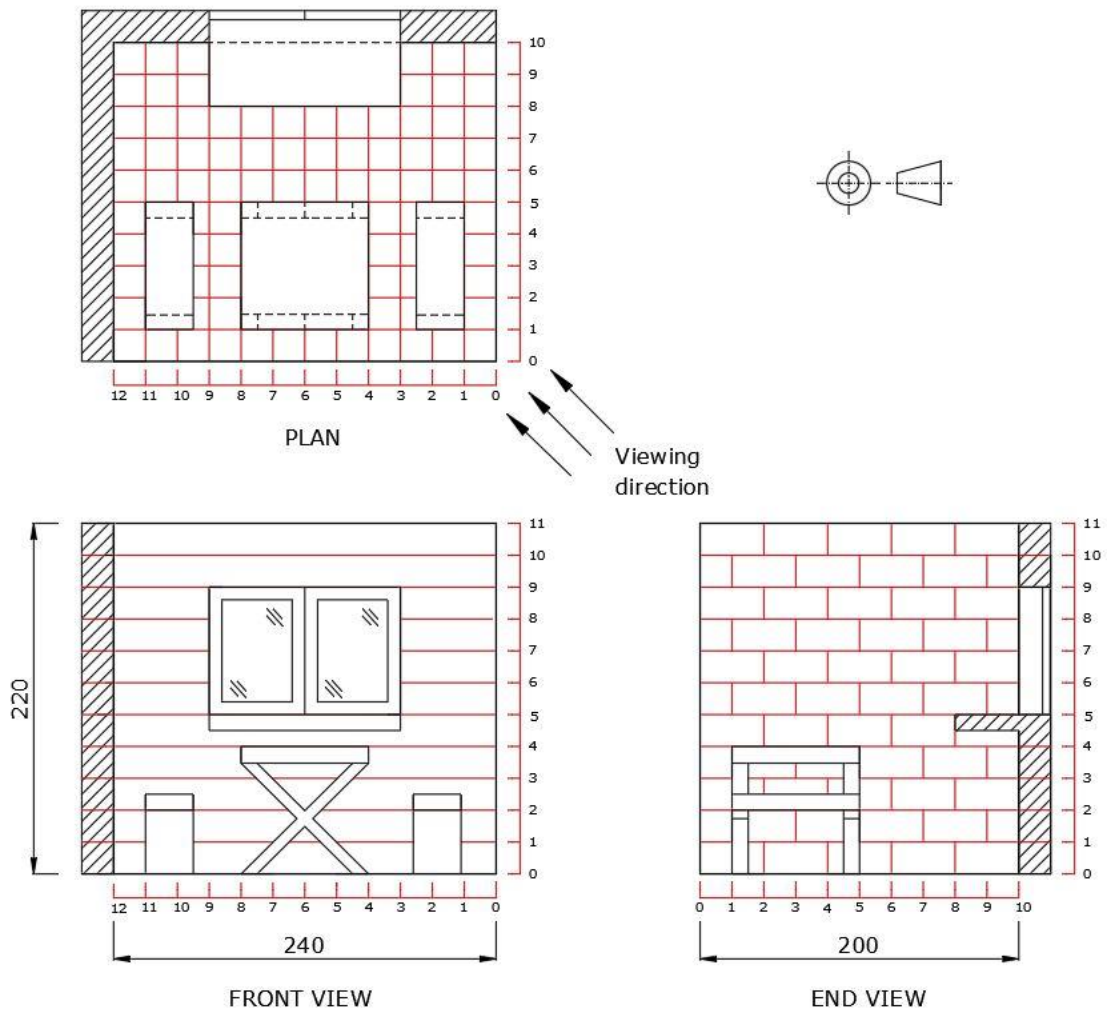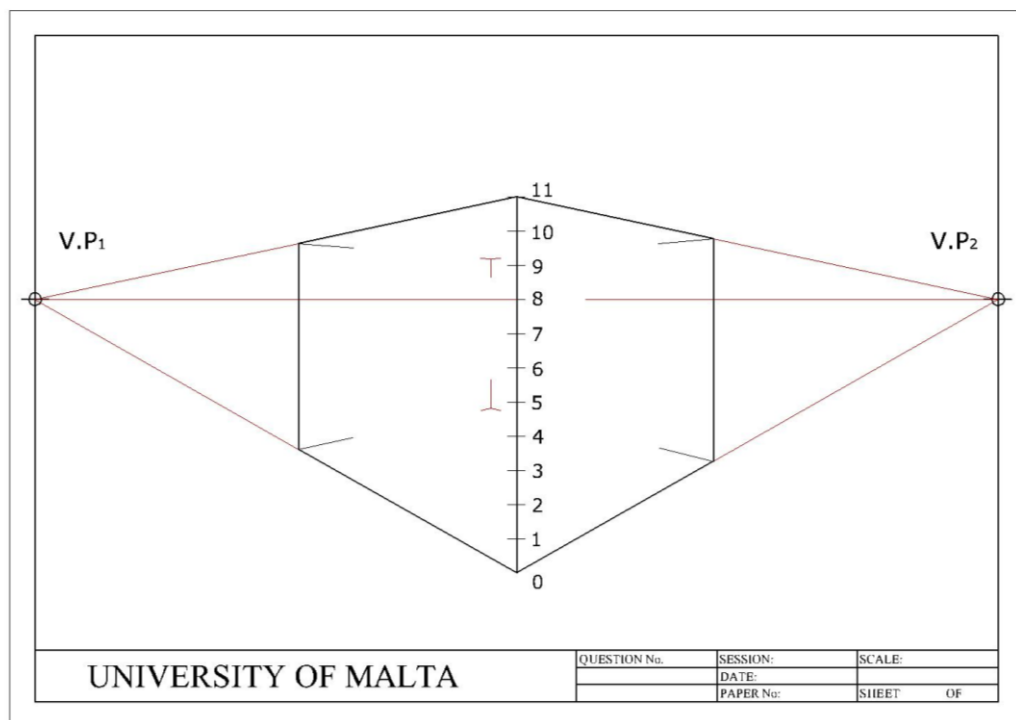
Figure 9c
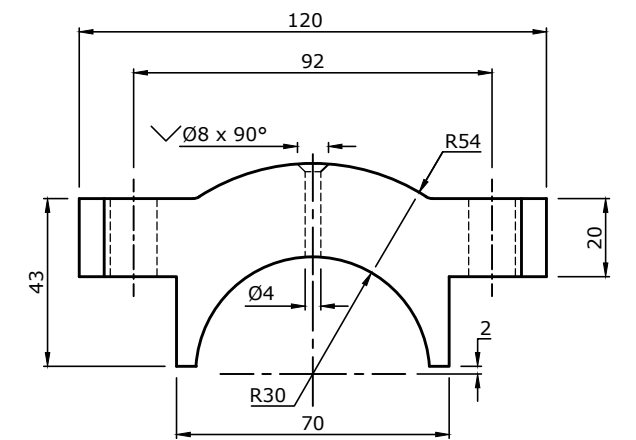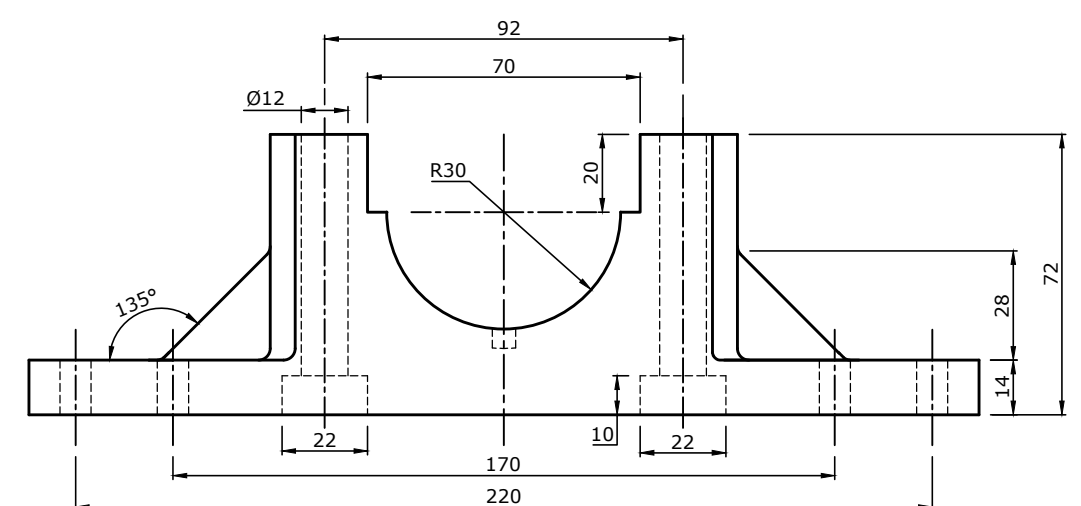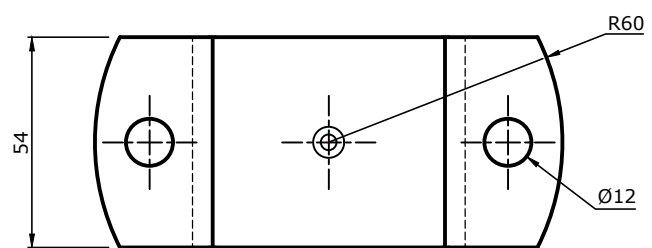
ITEM 2 (CAP 1 OFF)
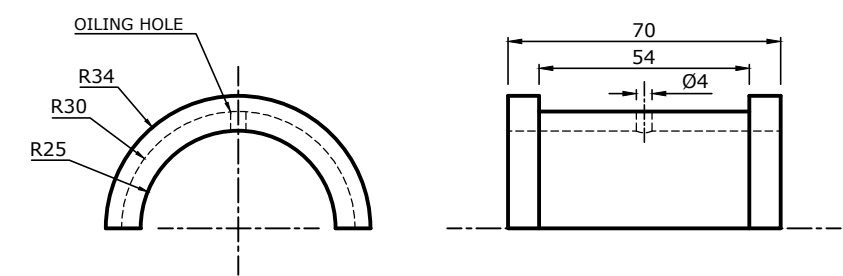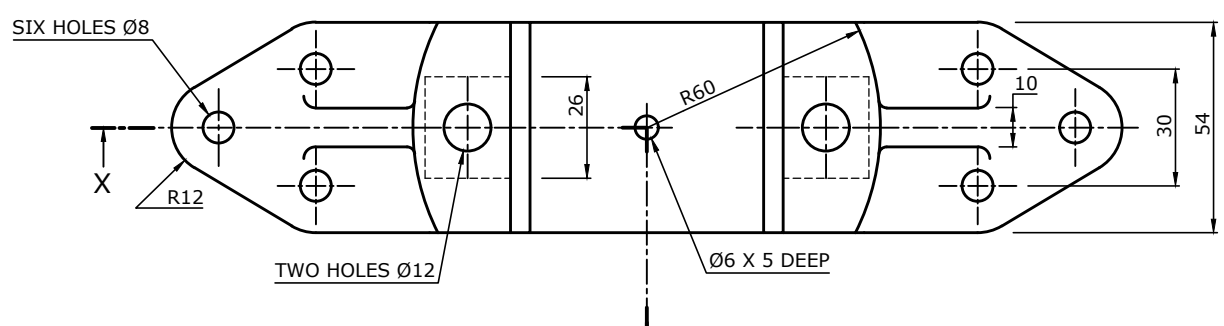
ITEM 3 (TOP BRASS 1 OFF)

OILING HOLE
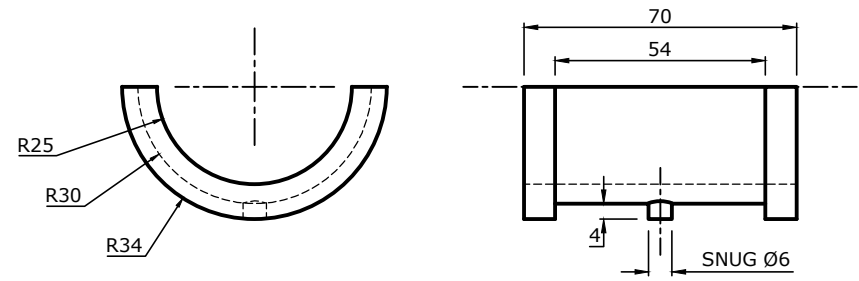
ITEM 4 (BOTTOM BRASS 1 OFF)

SNUG Ø6

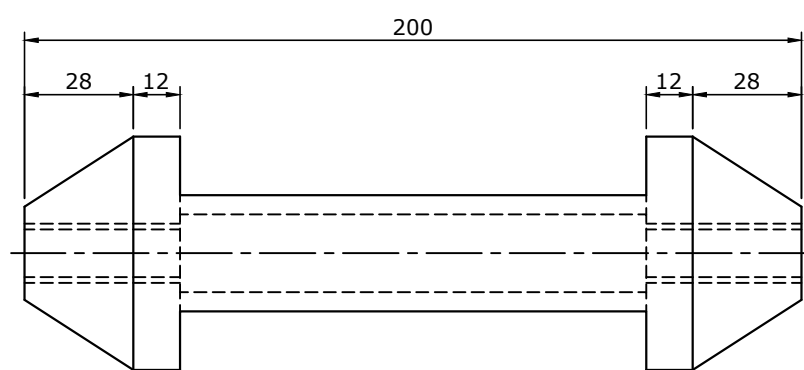ITEM 8 (SHAFT 1 OFF)

Ø50

M12 x 1.75
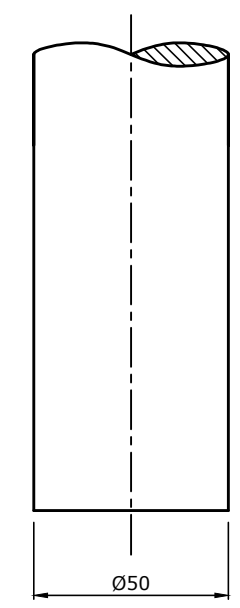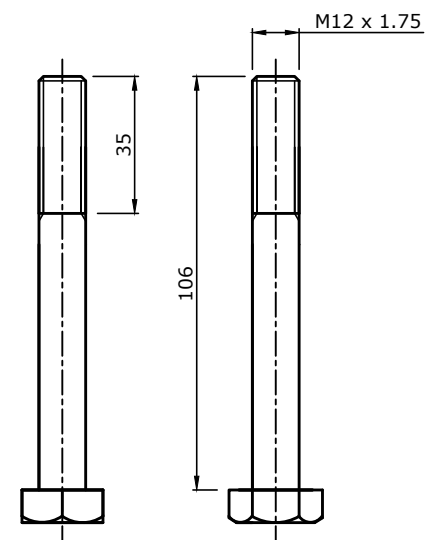
ITEM 5 (M12 BOLT 2 OFF)
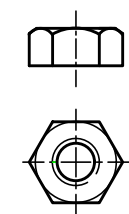
ITEM 6 (M12 NUT 2 OFF)   ITEM 7 (WASHER 2 OFF)

SIX HOLES Ø8

TWO HOLES Ø12

Ø6 X 5 DEEP

ITEM 1 (BASE 1 OFF)

R60

R30

R54

R60

Ø12

Ø8 x 90°

Ø4

R25

R30

R34

135°

JAW END (ITEM 3)

24
12
A-A

20 45 140
R30
98
M15 X 1.5 L.H.
A
A
Ø12
R25
DETAIL 'D'
X
X

HOOK END (ITEM 2)

140
R30
R15
M15 X 1.5 R.H.
98
R30
Ø15
X
X

FRONT ELEVATION

200
28 12
12 28

END ELEVATION

34
30
60°
Ø24 Ø60

HEX HD BOLT (ITEM 4)

65
30 M12

M12 HEX NUT (ITEM 5)

PLAN
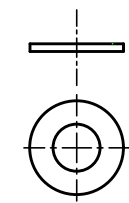
M15 X 1.5 L.H.
M15 X 1.5 R.H.
L
R
X
X
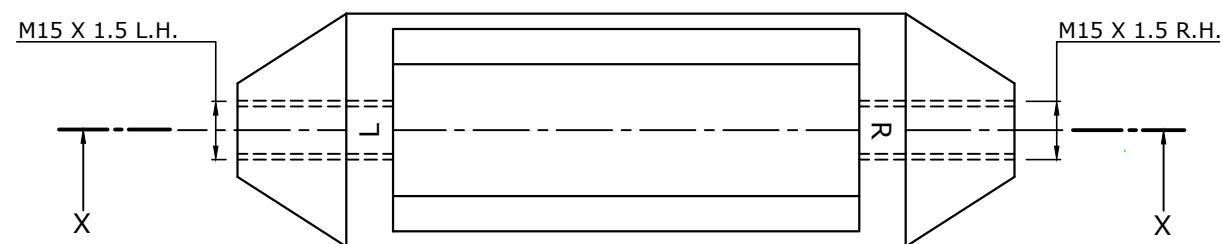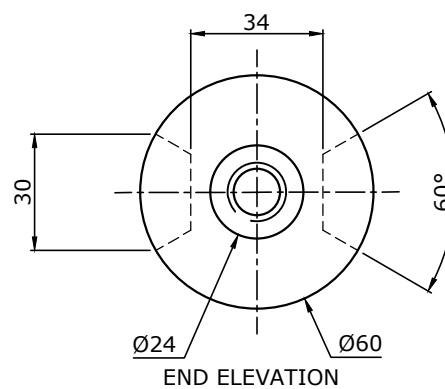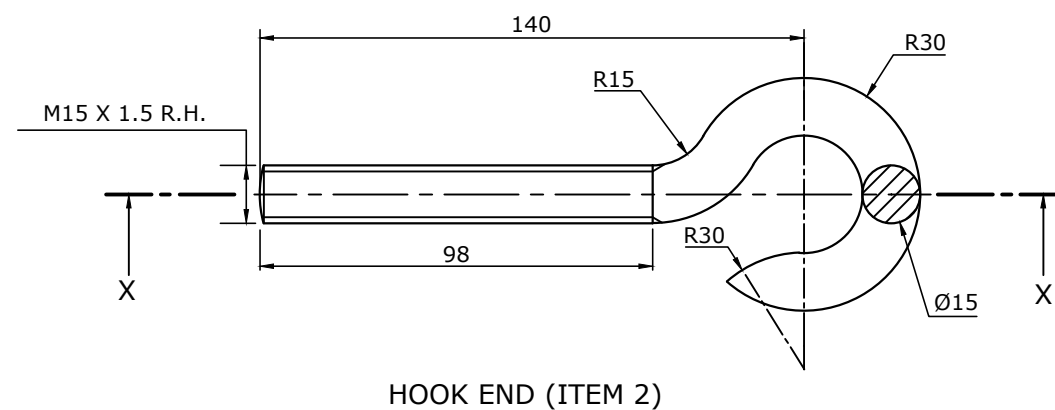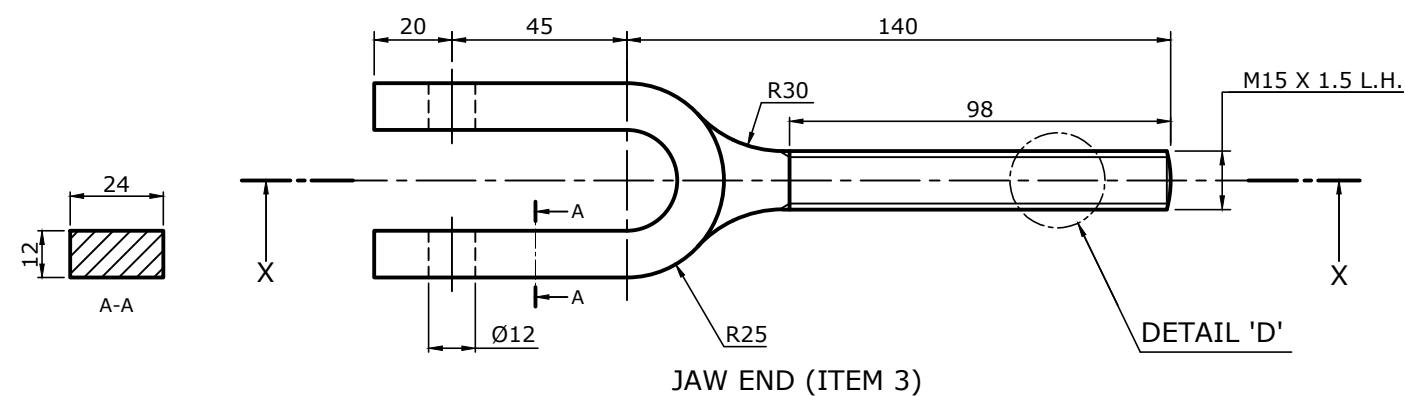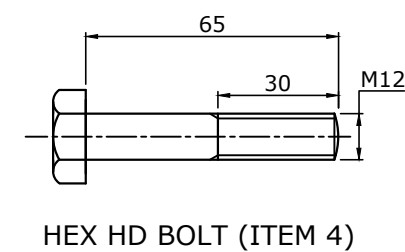
MAIN BODY (ITEM 1)

ITEMS LIST			
ITEM	QTY	ITEM NAME	MATERIAL
1	1	MAIN BODY	STAINLESS STEEL
2	1	HOOK END (V-THREAD M15 x 1.5 RH)	STAINLESS STEEL
3	1	JAW END (V-THREAD M15 x 1.5 LH)	STAINLESS STEEL
4	1	HEXAGONAL HEAD BOLT M12 x 1.75	STAINLESS STEEL
5	1	HEXAGONAL NUT M12 x 1.75	STAINLESS STEEL