

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD  
UNIVERSITY OF MALTA, MSIDA  
MATRICULATION EXAMINATION  
INTERMEDIATE LEVEL  
MAY 2014

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<b>SUBJECT:</b>	ENGINEERING DRAWING AND GRAPHICAL COMMUNICATION
<b>DATE:</b>	10th May 2014
<b>TIME:</b>	9.00 a.m. to 12.00 noon

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**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:

- B.S. or equivalent (ISO) recommendations should be adopted throughout your answers;
- all dimensions are in millimetres, unless otherwise stated;
- all answers are to be accurately drawn with instruments;
- all construction lines must be left in each solution;
- 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 only **FOUR** questions from this section.

**Question 1**

A light trapdoor HT, is hinged at edge H and held at  $30^\circ$  to the horizontal by a wire attached at T. The door carries two vertical loads of 4kN and 6kN, spaced as shown in Figure 1. The trapdoor is in equilibrium under the action of the given loads.

Find graphically:

- the magnitude, direction and sense of the reaction at H,
- the magnitude of the pull at T.

**(13 marks)**

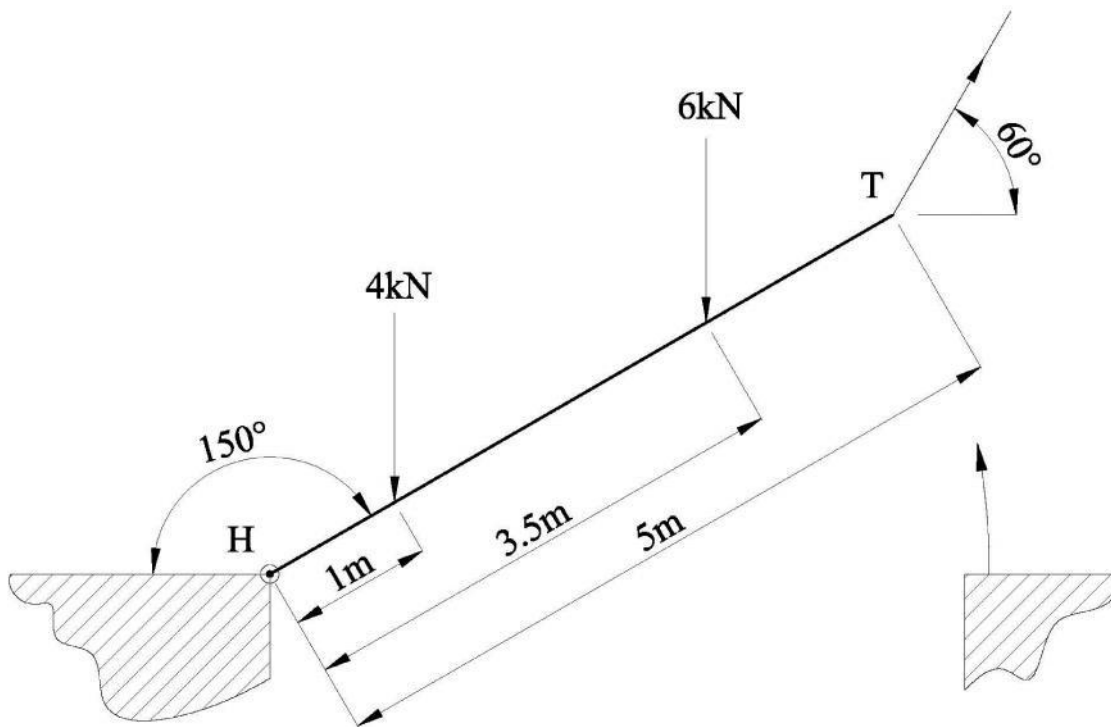


FIG.1

**Question 2**

A sheet metal funnel, formed from a cylinder and a square pyramid, is shown.

- Copy full size, the drawing shown in Figure 2.
- Determine, by construction, the curves of intersection.
- Draw an auxiliary view as seen when looking in the direction of arrow A.

(13 marks)

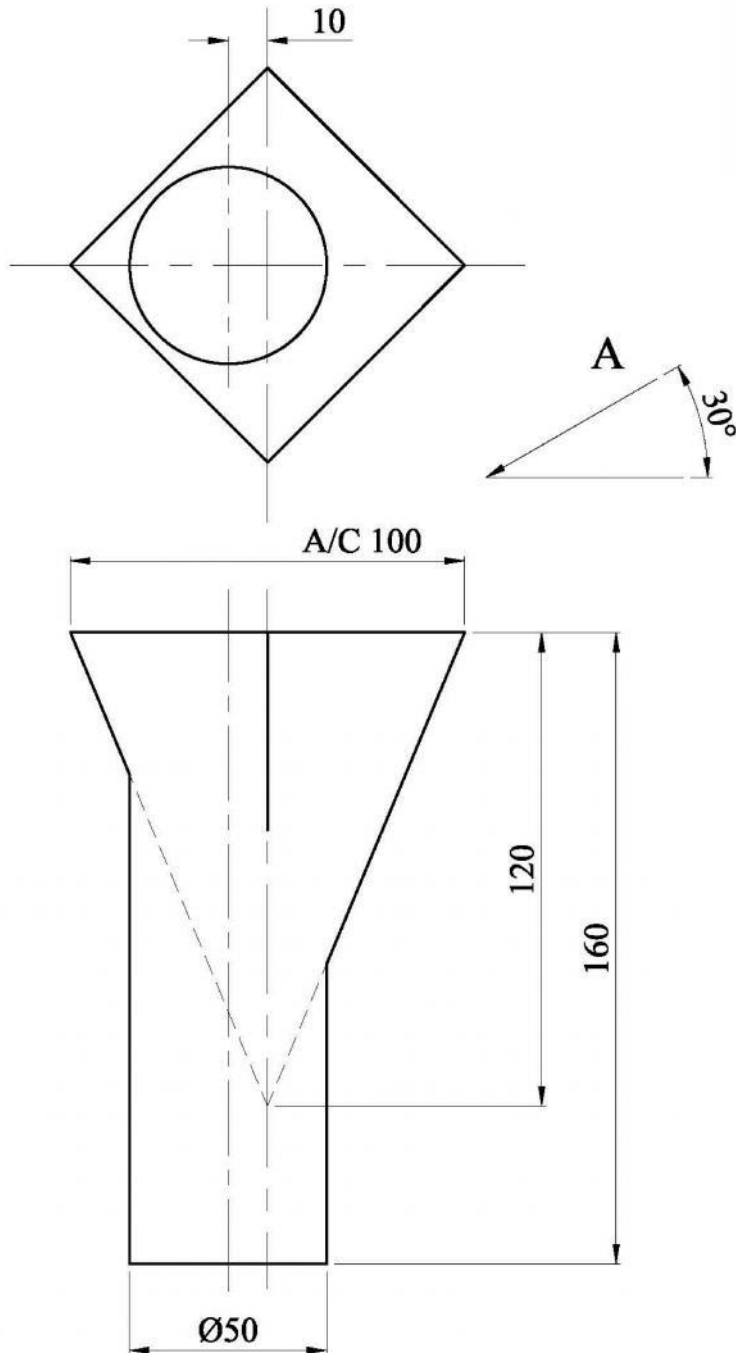
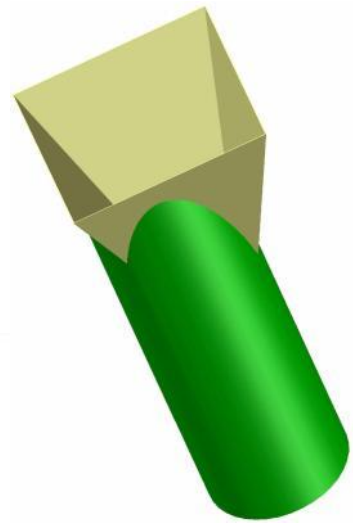


FIG.2

**Question 3**

A 3-D model of a Spinning Wheel is shown on the right.  
The figure below shows a profile of one of the blades.

Construct full size;

- a) the Hyperbolic conic curve V2 A, using eccentricity of 5:3,
- b) the Parabolic curve V1 A.

In your answer present neat construction showing how the two curves are drawn.

**(13 marks)**

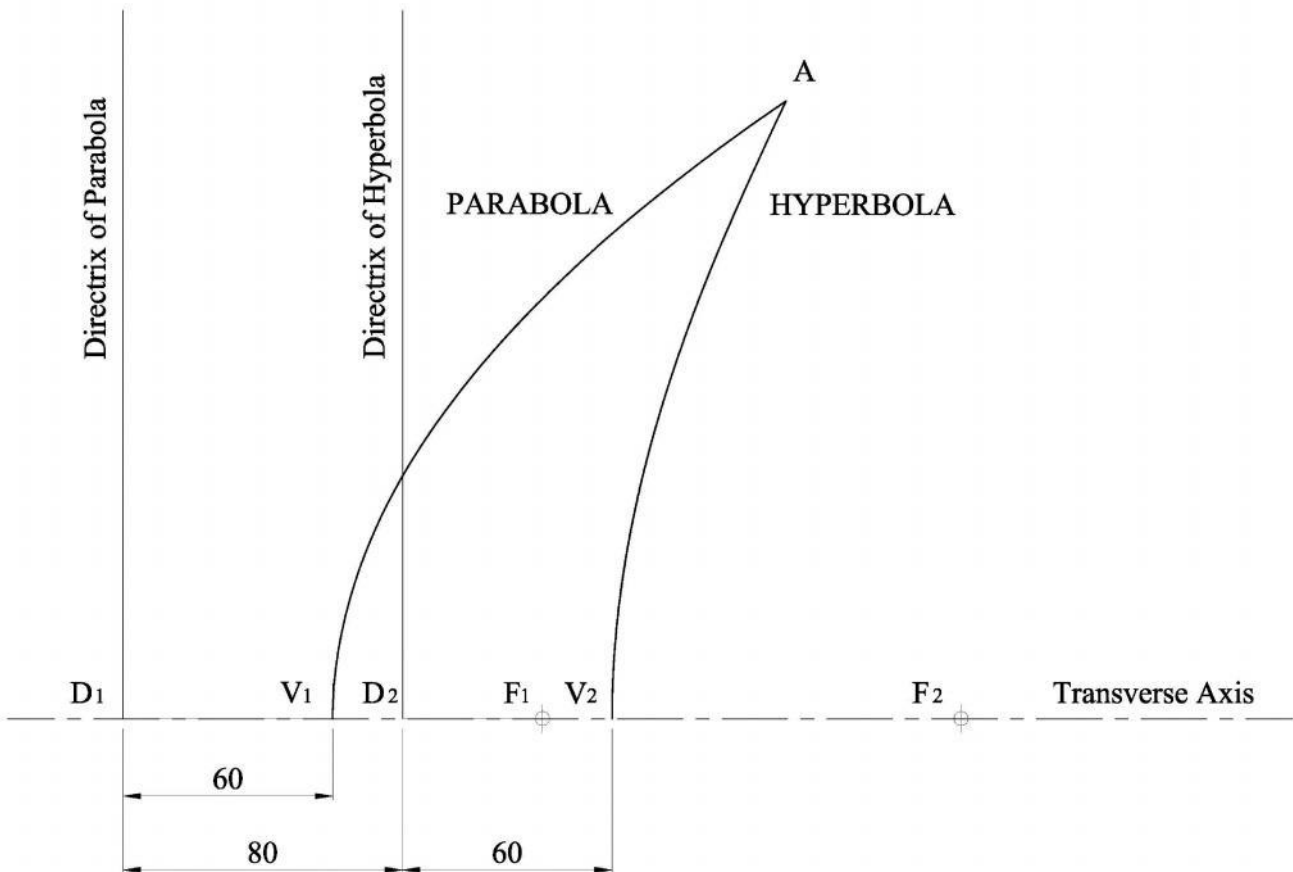
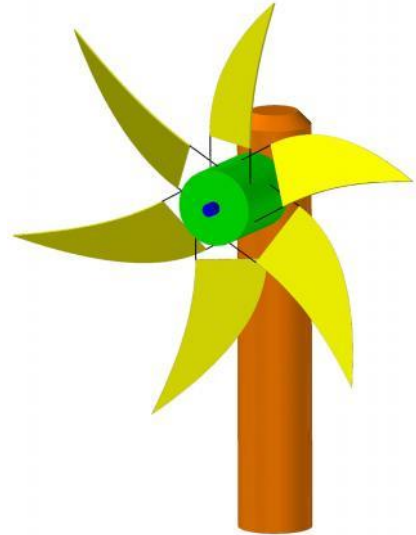
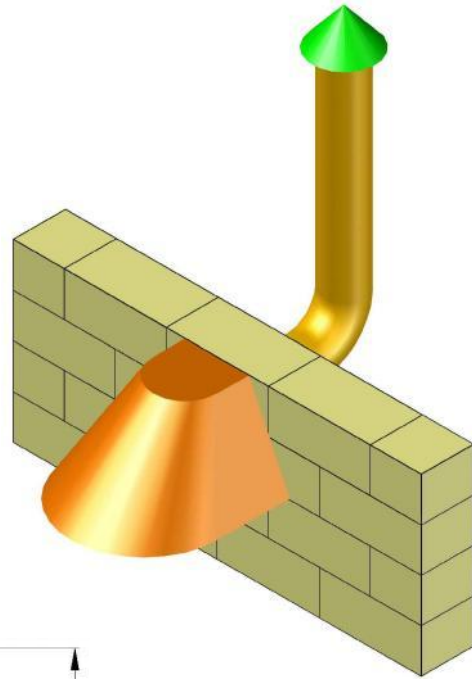


FIG. 3

**Question 4**

The 3-D drawing shows a smoke hood which is fixed on the vertical side and connected to a chimney. The top of the hood is blanked up and smoke flows through an opening on the rear flat side of the hood, attached to the wall. The hood is formed from half an oblique cone frustum with extended flat surfaces on each side.



- Copy full size the two elevations (views) of the hood shown in Figure 4.
- Construct the necessary true lengths required to draw its development.
- Draw half the development pattern of the hood.

**(13 marks)**

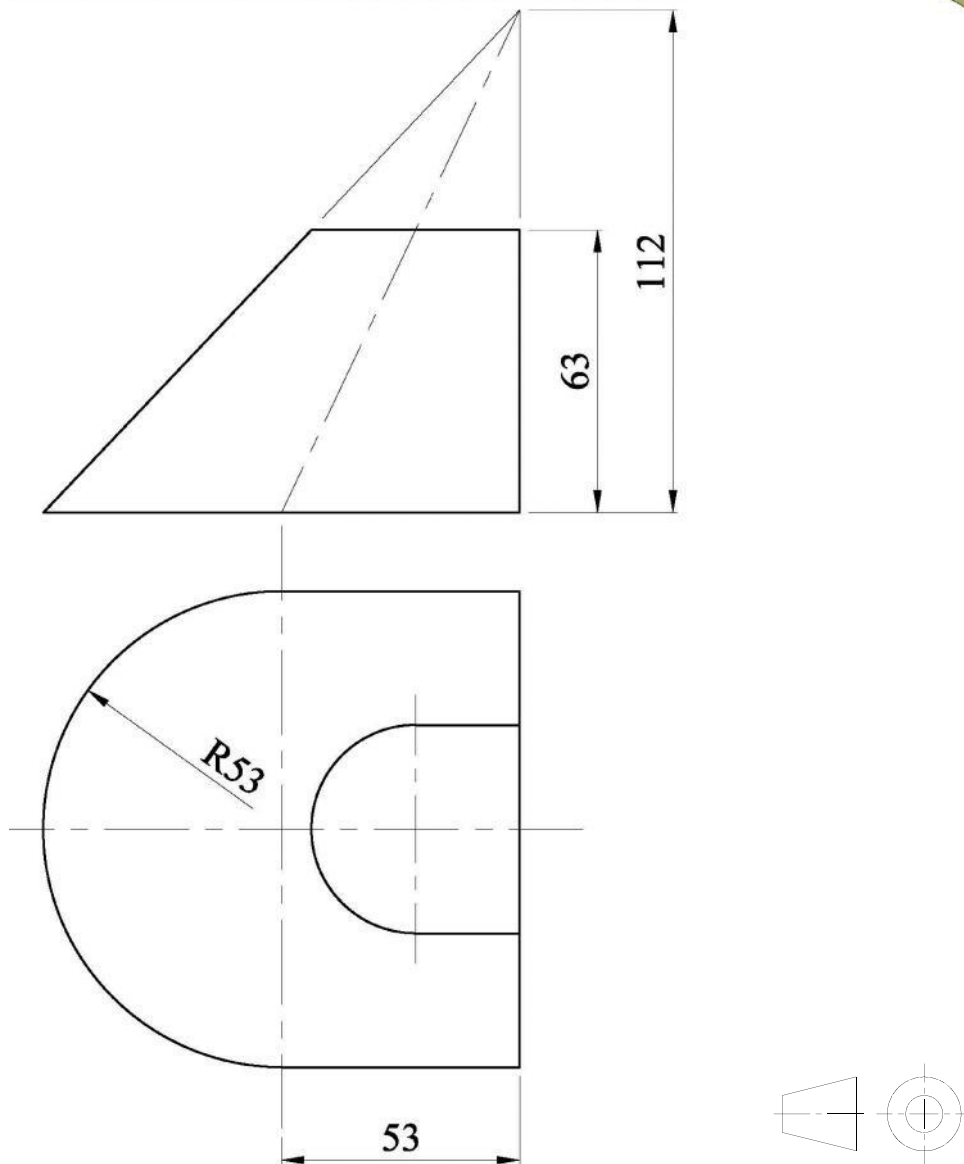


FIG. 4

**Question 5**

Design a radial plate cam to fulfil the following conditions;

- i) the follower is to be drawn in-line with the cam shaft centre,
- ii) the base of the flat foot follower is to be drawn 80mm diameter,
- iii) the rotation of the cam is to be anticlockwise,
- iv) the motion given to the flat foot follower is shown below.

0° - 180°	Follower to fall a distance of 60mm with uniform acceleration and uniform retardation motion.
180° - 300°	Follower to rise a distance of 50mm with simple harmonic motion.
300° - 360°	Follower to rise a distance of 10mm with uniform velocity.

Draw the performance graph and construct the profile of the cam.

**(13 marks)**

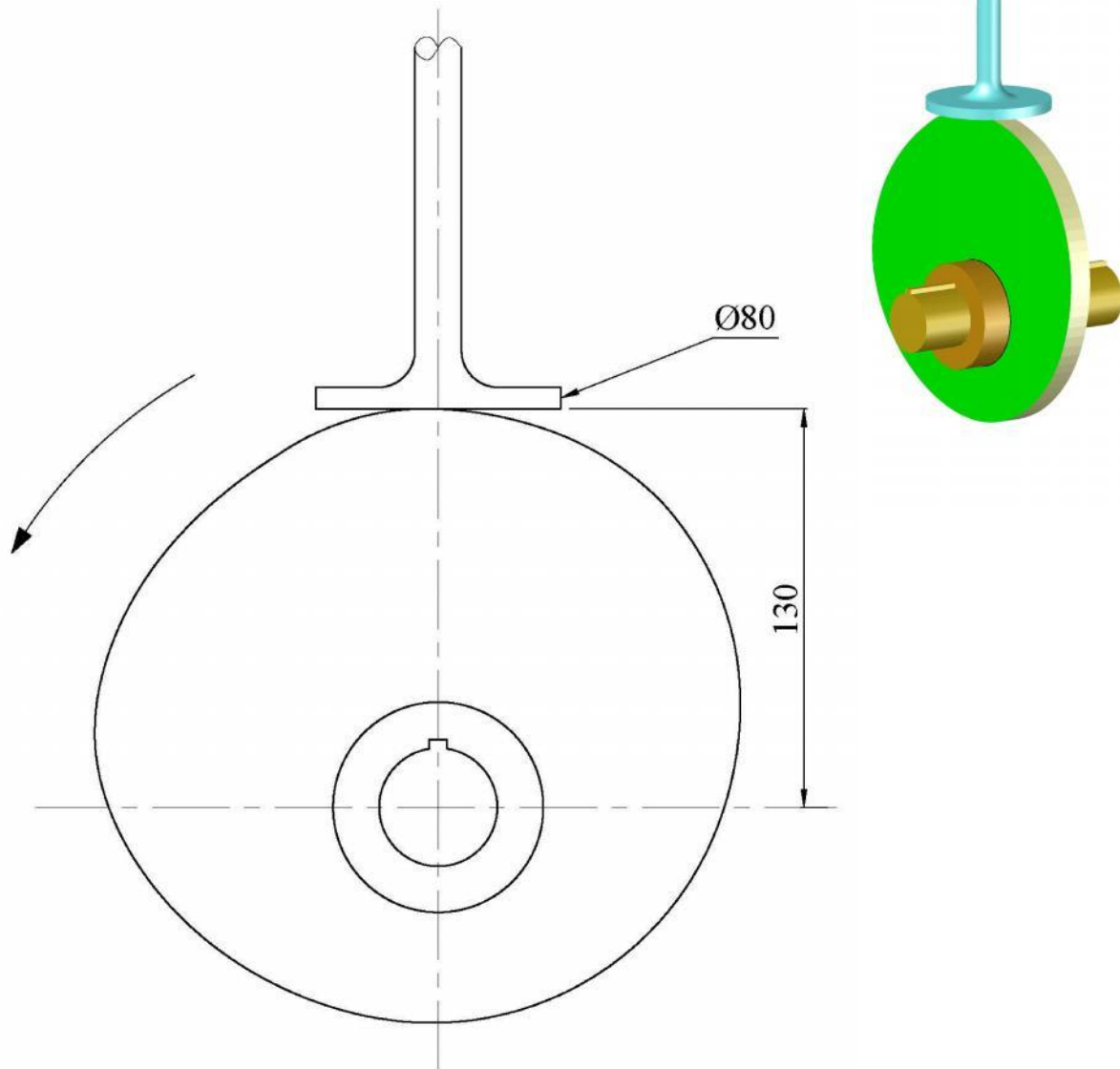


FIG. 5

## SECTION B

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

### Question 6

Figure 6a (attached) shows details of the component parts of a BELT DRIVE UNIT. The unit, shown pictorially below in Figure 6b, is assembled as follows.

- The bush (item 2) is pressed into the 46mm diameter bore in the hub of the housing (item 1).
- The housing with the bush is placed onto the bracket (item 3) with Face A of the housing resting against Face B of the bracket and secured in position by means of six hexagonal headed M12 bolts (item 4).
- The key (item 5) is placed into the key slot recess of the 30mm diameter spindle portion of the shaft (item 6).
- The shaft is fitted in the 30mm diameter bore of the vee pulley (item 7 shown sectioned for clarity), and secured in position using a washer and an M24 hexagonal nut.
- The shaft and pulley assembly is fed through the bush installed in the housing until Face C is in contact with Face D of the housing.

Draw, full size, a front elevation of the assembled belt drive, showing:

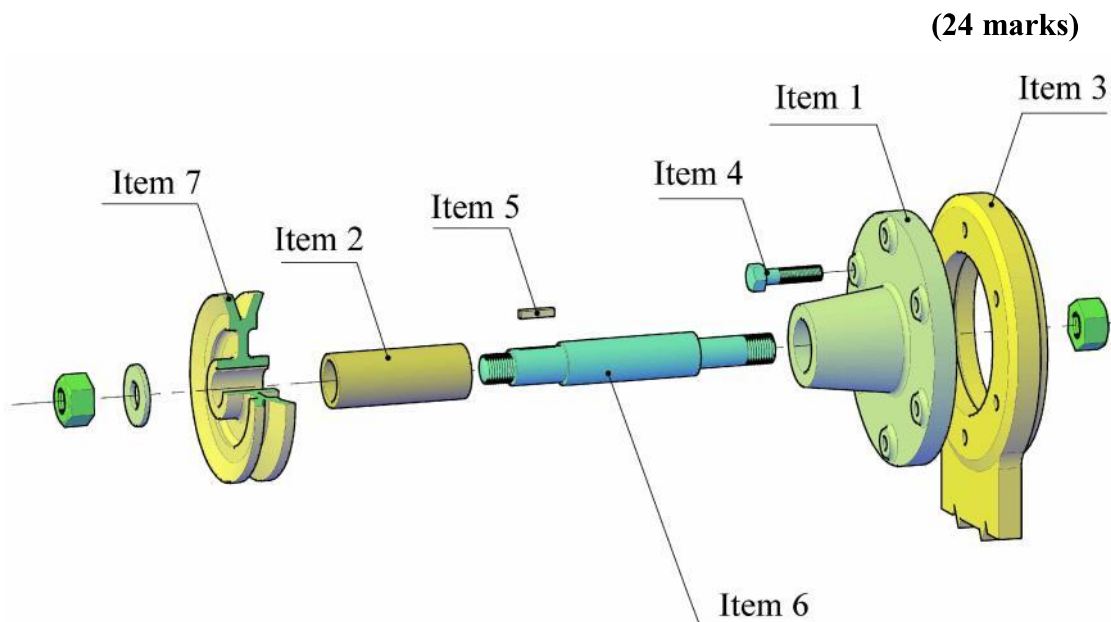
- the top half in section on the plane X – X;
- the bottom half is to be shown as an outside view.

*Notes:*

*Show the M12 bolt in position on the top half of the sectional elevation only.*

*Represent the key as a local section on the top half of the sectional elevation.*

*Draw, in position, the M12 bolt and the key, as a local section, on the top half of the sectional elevation.*



EXPLODED VIEW OF THE COMPONENT PARTS OF THE BELT DRIVE UNIT

FIG. 6b

Question 7

The illustration below (Figure 7) shows a driving pinion gear wheel having 15 teeth. Part of a rack, which is to mesh with the pinion, is shown beneath the pinion gear wheel. The pinion gear teeth are of involute form, with a pressure angle of  $20^\circ$  and a module of 20mm.

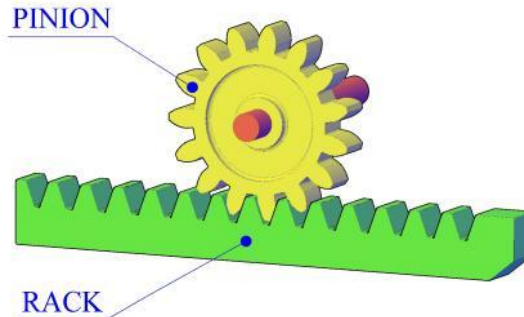
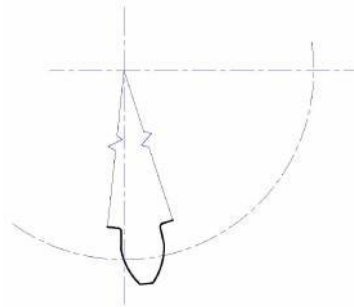


FIG. 7

a) State the basic terminology common to gears.

b) Calculate the necessary data and present your calculations in an organized manner.

c) Construct full size, by using neat construction lines, one pinion tooth. The flank face must be of true involute form as shown in Figure 7a.



GEAR TERMINOLOGY
GEAR DATA AND CALCULATIONS

FIG. 7a

d) Draw an isometric view of the pinion gear tooth.

e) Include, beneath the pinion gear tooth, an isometric view of a part of the rack, which is suitable to mesh with the pinion rear tooth as shown in figure 7b.

Note:

- i) do not draw the rack in mesh with the pinion gear tooth,
- ii) do not use isometric scale.

**(24 marks)**

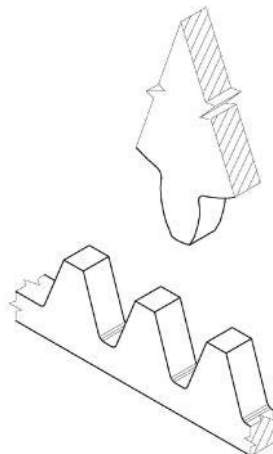


FIG. 7b



## SECTION C

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

### Question 8

Figure 8a shows a new design idea of a wedding souvenir which consists of small cardboard containers having the shape of a groom's suit. A cardboard, which is coloured black on one side and white on the other side is cut, folded and glued manually.

This idea is to be suggested on an online wedding magazine and **you have been asked to design a pictorial instruction chart to depict the following stages:**

- Download and print the surface development (given below) on the white side of the cardboard.
- Cut carefully around the surface development and the handkerchief slot.
- Fold along the folding lines.
- Put glue on the black side of the tabs (shown shaded).
- Tuck the tabs and leave to dry.
- Insert and glue the handkerchief.



Figure 8a

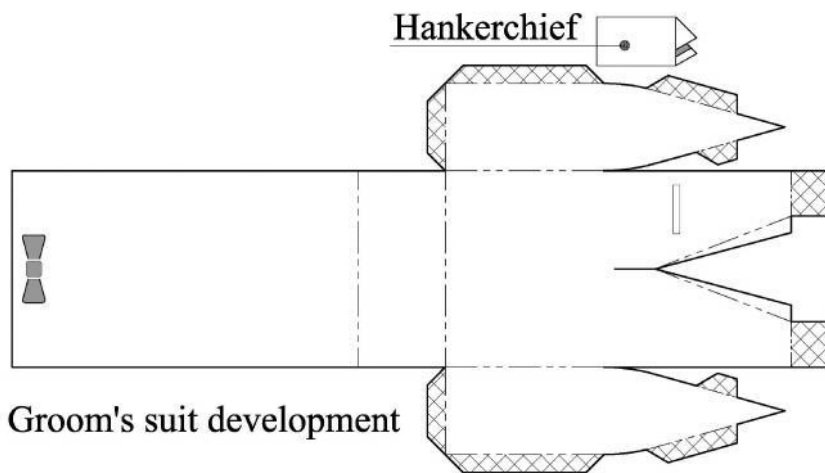


Figure 8b

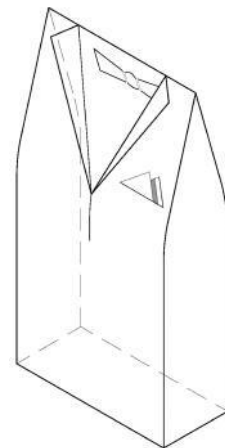


Figure 8c

You are required to:

- Prepare three annotated preparatory sketches to illustrate your developing ideas regarding the layout and presentation of the chart.
- Clearly identify the elements that you intend to use in your final chart.
- Draw the final illustrated chart.
- Apply colour neatly to enhance your visual aid.

**(24 marks)**

**Question 9**

A wedding filming company decided to participate in the annual wedding fair. The fair stand planner designed orthographic views of the proposed layout (see Figure 9c). The stand consists mainly of a raised platform and an L-shaped gypsum wall (see Figure 9b). The floor is paved with square tiles and the gypsum wall is 8 courses high. The dimensions of the square tiles and the height of the courses are equal.

The proposed furniture consists of:

- one desk ‘A’;
- one L-shaped welcome desk ‘B’;
- one coffee table ‘C’;
- one cupboard ‘D’;
- one sofa ‘E’;
- one keyboard shelf ‘F’;
- three monitors ‘G’.

Details of the furniture are given below, in Figure 9a.

Using an appropriate scale, produce an **estimated two-point perspective view** of the stand.

*Notes:*

- *The viewing direction is indicated by the large arrows at the bottom of Figure 9c.*
- *It is suggested that the eye-level will be set on the top of the monitors.*
- *The company logos are mounted on illuminated plastic sheets.*
- *Render your drawing to enhance the solution.*

**(24 marks)**

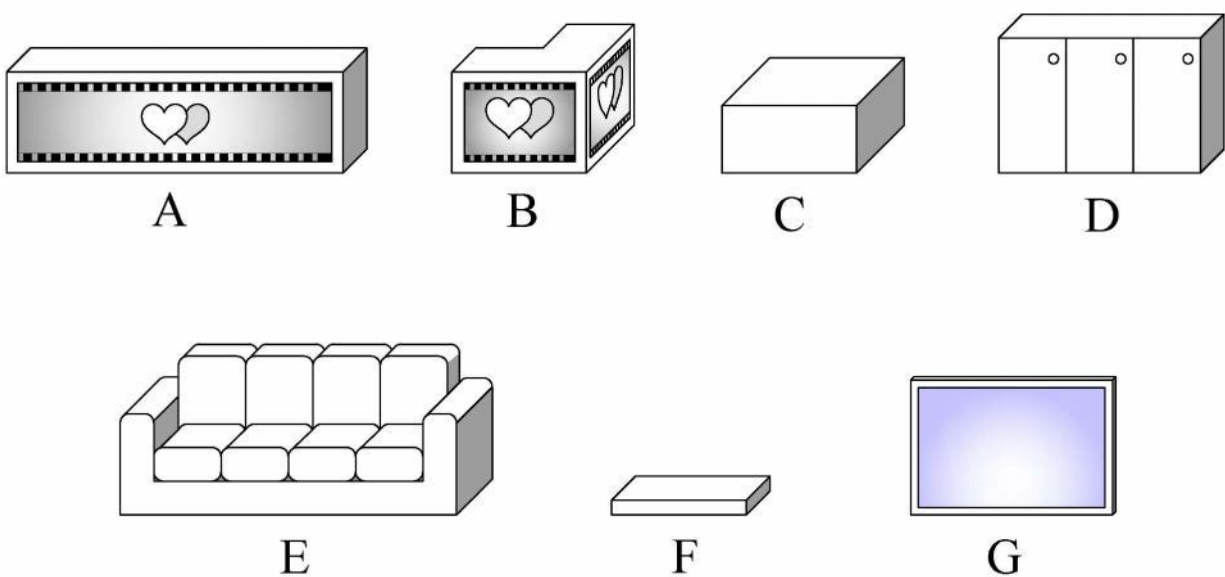


FIG. 9a

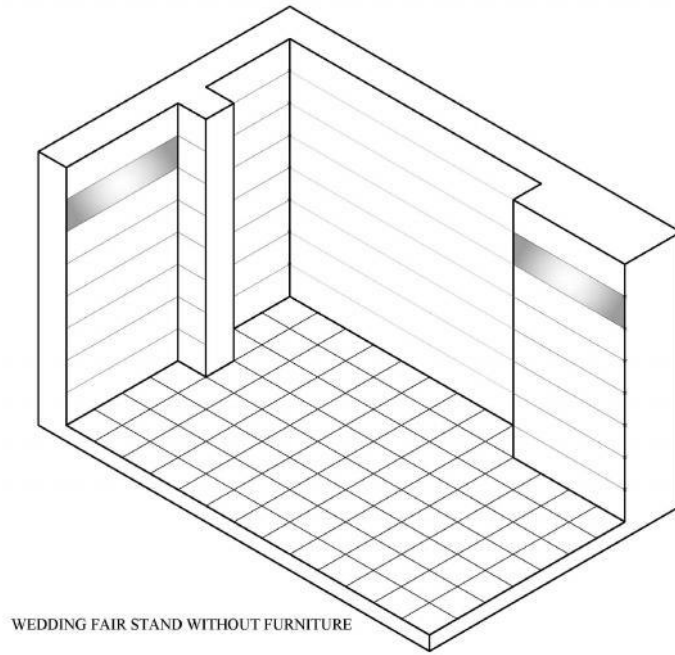


FIG. 9b

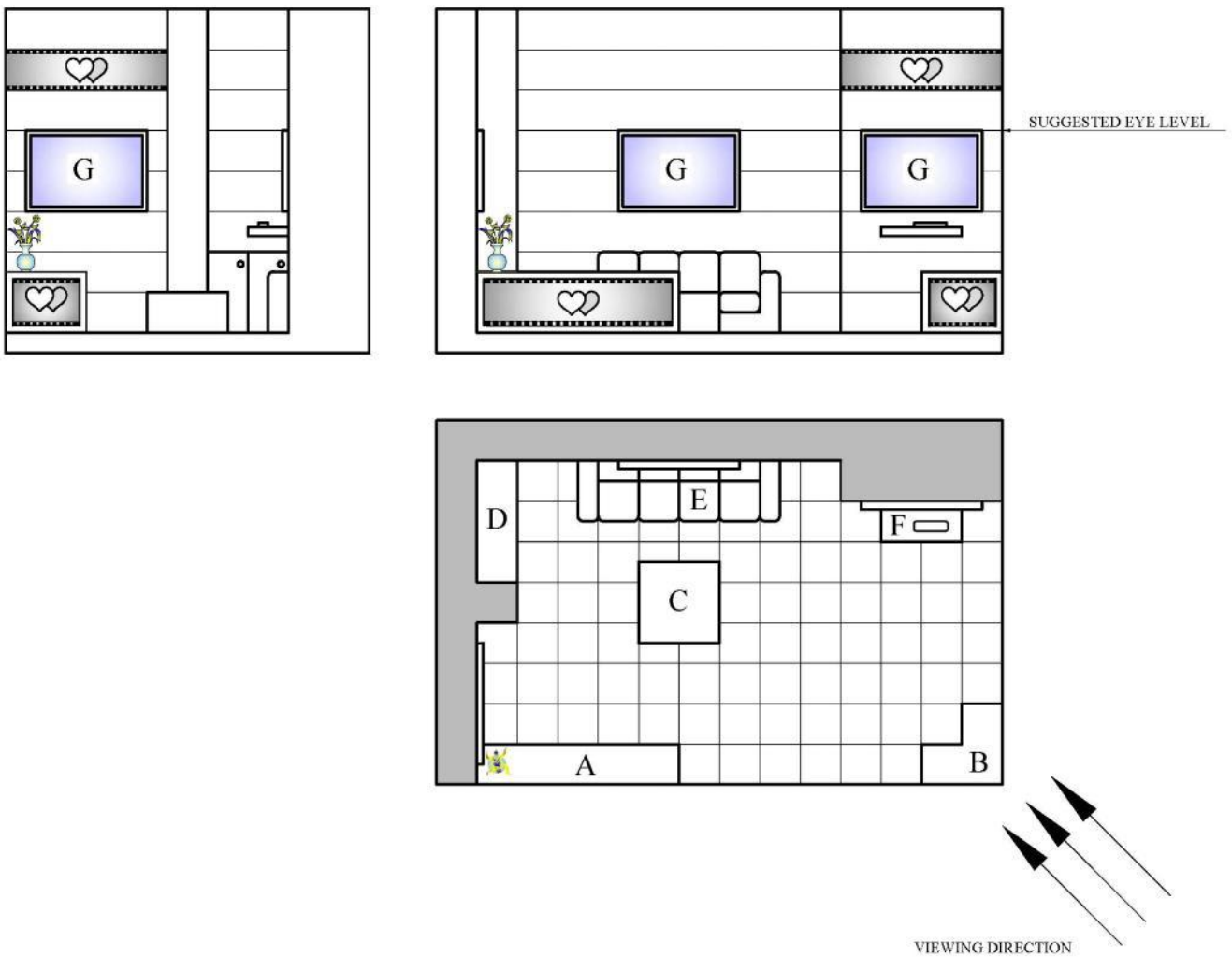
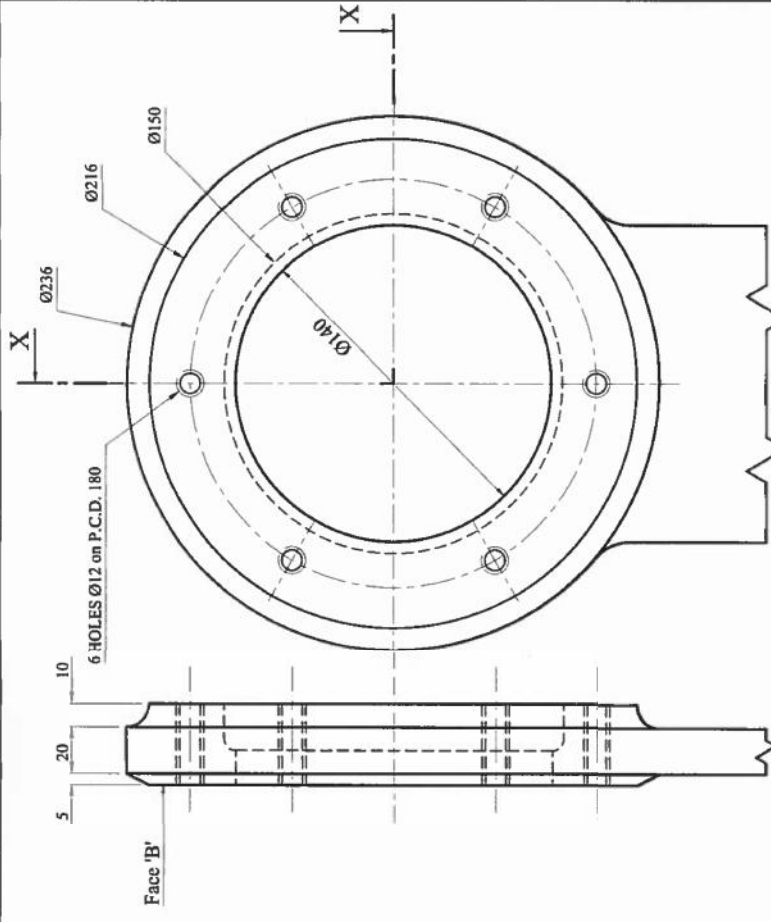
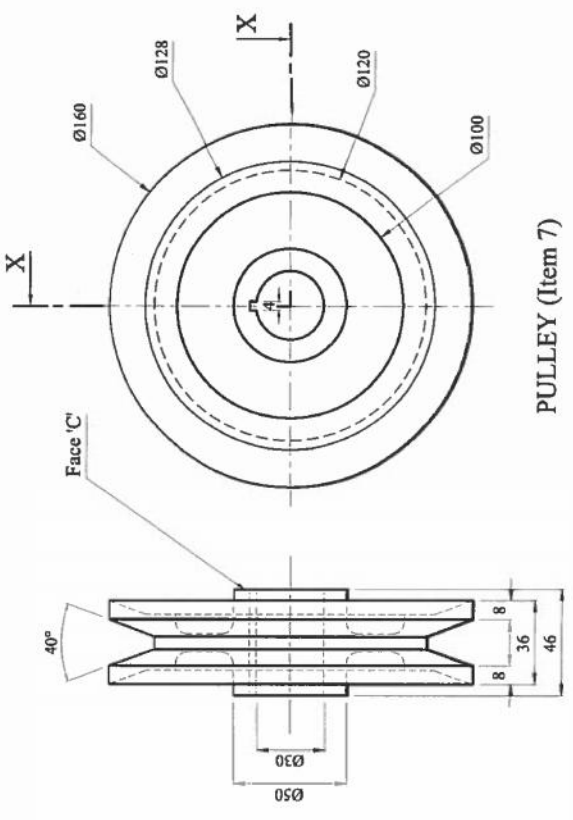


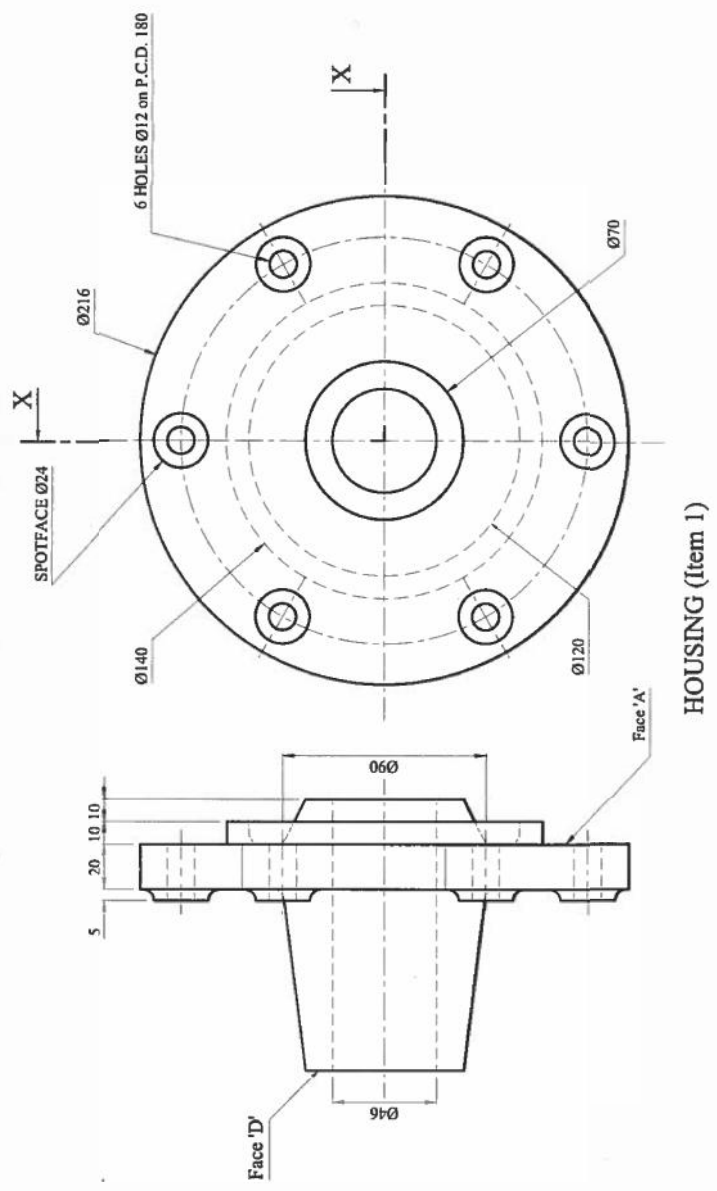
FIG. 9c



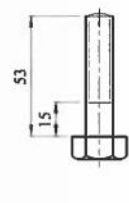
BRACKET (item 3)



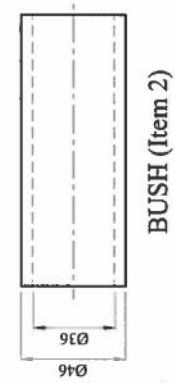
PULLEY (Item 7)



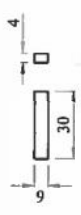
HOUSING (Item 1)



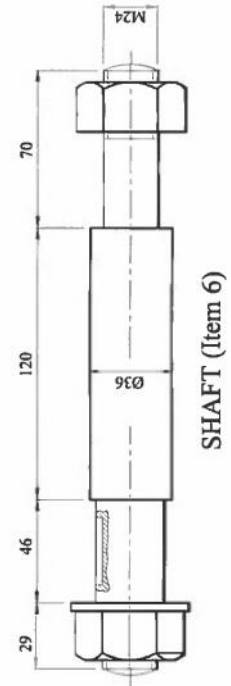
HEXAGONAL BOLT M12 (Item 4)



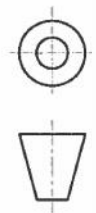
BUSH (Item 2)



KEY (Item 5)



SHAFT (Item 6)



FILLET RADII 5mm unless otherwise stated