

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD  
UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION  
ADVANCED LEVEL  
MAY 2014

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<b>SUBJECT:</b>	ENGINEERING DRAWING/GRAPHICAL COMMUNICATION
<b>PAPER NUMBER:</b>	I
<b>DATE:</b>	9 <sup>th</sup> 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.

Attempt **any five** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

- drawings should conform to B.S. or equivalent (ISO) standards;
- all dimensions are in millimetres;
- all answers are to be accurately drawn with instruments;
- unless otherwise stated, 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.

**Question 1**

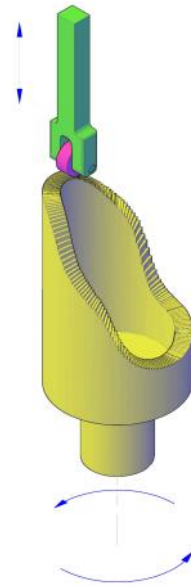
The cylindrical cam shown has its end machined to the required shape to form an end cam.

- a) Draw the incomplete elevation and plan of the end cam shown in Figure 1.
- b) Construct the development of the cam surface, if the end cam is to move the roller-ended follower as follows:

Follower dwells for one twelfth of a revolution of the cam.
Follower to move 120mm upwards for the next half revolution with uniform acceleration and uniform retardation motion.
Follower to dwell for one-twelfth of a revolution.
Follower to return to the start position with simple harmonic motion the remainder of the revolution of the cam.

- c) Complete the front elevation of the cam by drawing a fair curve showing the profile of the end cam, including the hidden detail.

*Note: The cam rotation is anticlockwise.*



**(20 marks)**

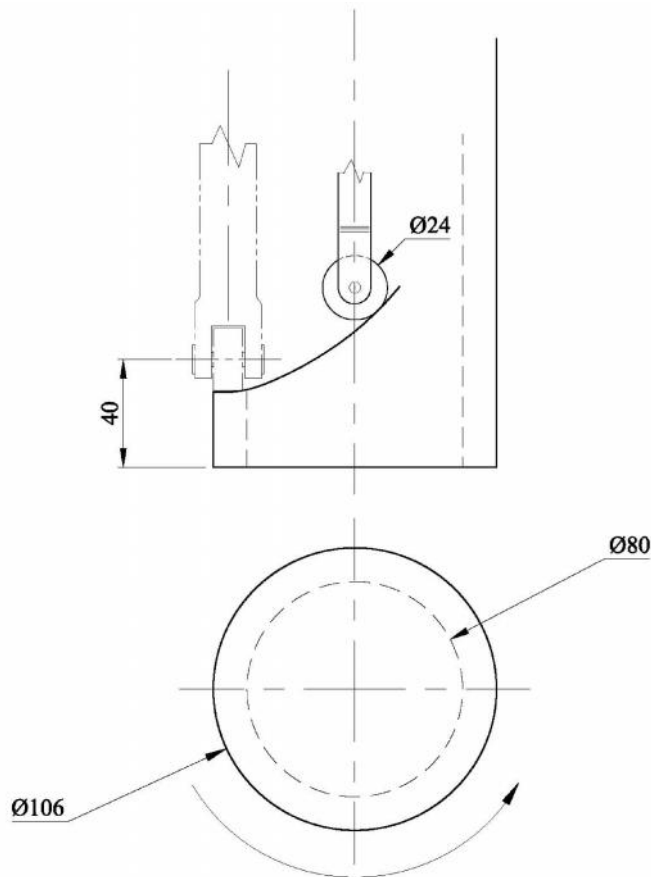


Figure 1

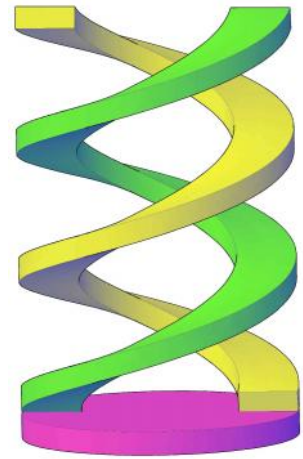
**Question 2**

The illustration shows a stand used for exhibiting tools and various engineering items on display for sale in an establishment. The display stand is formed from two continuous strips of mild steel (flat) bars welded to a base. The flat bars are twisted to form a double right-hand helix.

Using the dimensions of the stand, shown in Figure 2, draw, to a scale of 1:1, a front elevation showing a true projection of one and a half pitches of the helix.

*All helices are to be shown.*

*Hidden detail is not required.*



**(20 marks)**

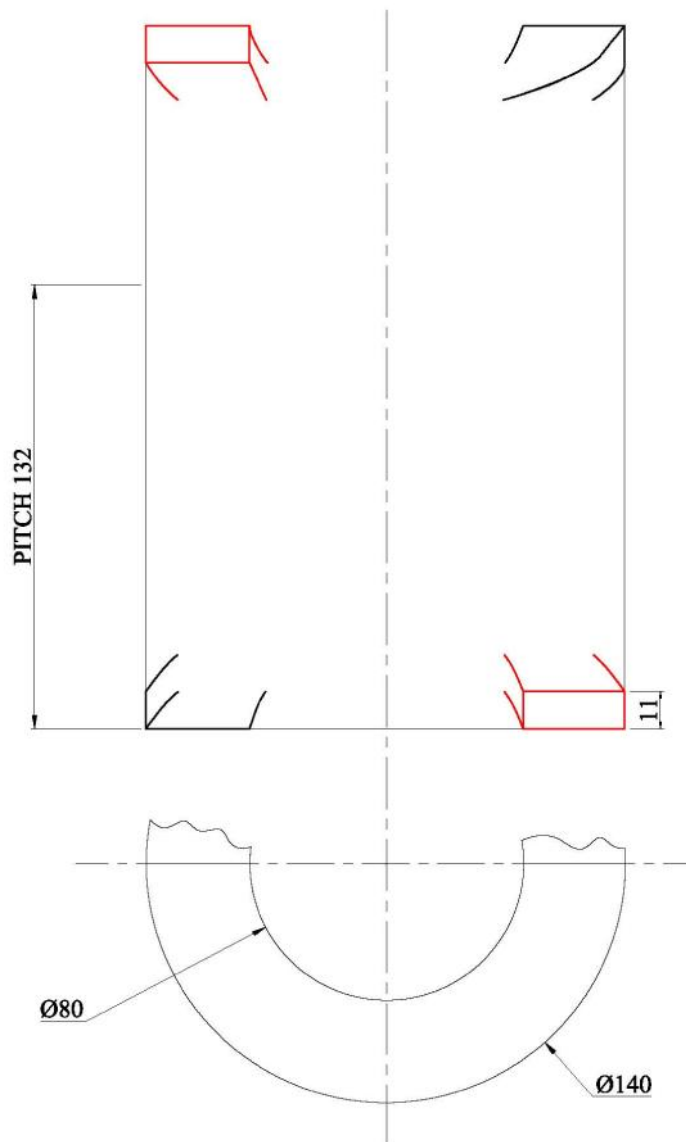
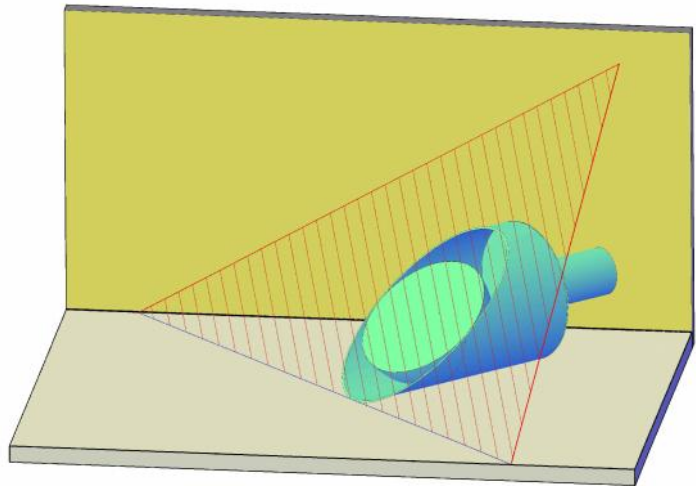


Figure 2

**Question 3**

Figure 3 below shows the plan and elevation of a sphere inside a cylindrical scoop. The lines VT and HT represent the traces of an oblique plane which cuts both the cylinder and the sphere. The cylindrical scoop rests on the horizontal plane at an angle of  $45^\circ$  to the vertical plane.



Draw full size:

- a) The auxiliary view showing the oblique plane as an inclined plane. Measure and state the true angle the oblique plane makes with the horizontal plane.
- b) The given elevation and plan with the portion in front of the cutting plane removed.

*Notes:*

*Do not show the section hatching.*

*The material of the cylinder is of negligible thickness.*

**(20 marks)**

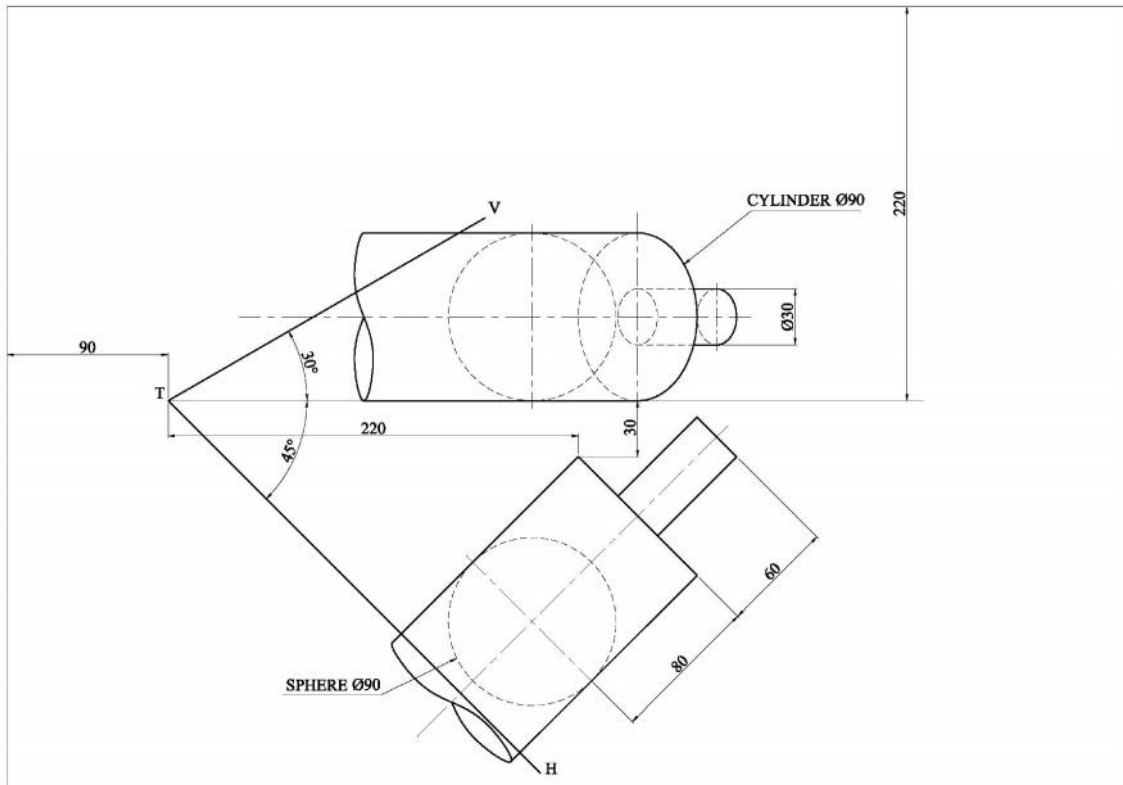


Figure 3

**Question 4**

Part of a mechanism installed on a machine moves two racks in opposite direction by means of a gear wheel. Figure 4 shows the racks in mesh with the driving gear wheel.

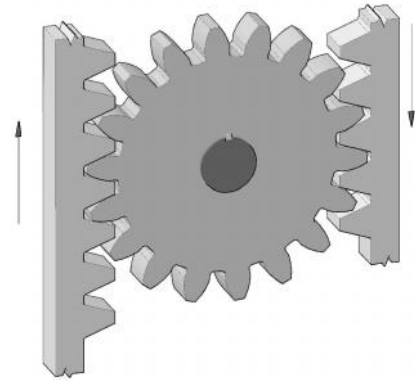


Figure 4

- a. Using the formulae and the following data, complete the table in Figure 4a before beginning the drawing.  
 Driving pinion – 18 teeth.  
 Module – 16  
 Pressure angle 20°  
 The pinion teeth profile is of true involute form.
- b. Construct, full size, a pinion tooth flank face of true involute form.
- c. Draw one tooth of the pinion meshing with two teeth of a straight rack.  
 Note:  
 The racks are to be presented in a vertical position with the pitch point of the gear tooth on the same horizontal centre-line;  
 (i) on the left hand side.  
 (ii) on the right hand side (as shown in Figure 4a).

**(20 marks)**

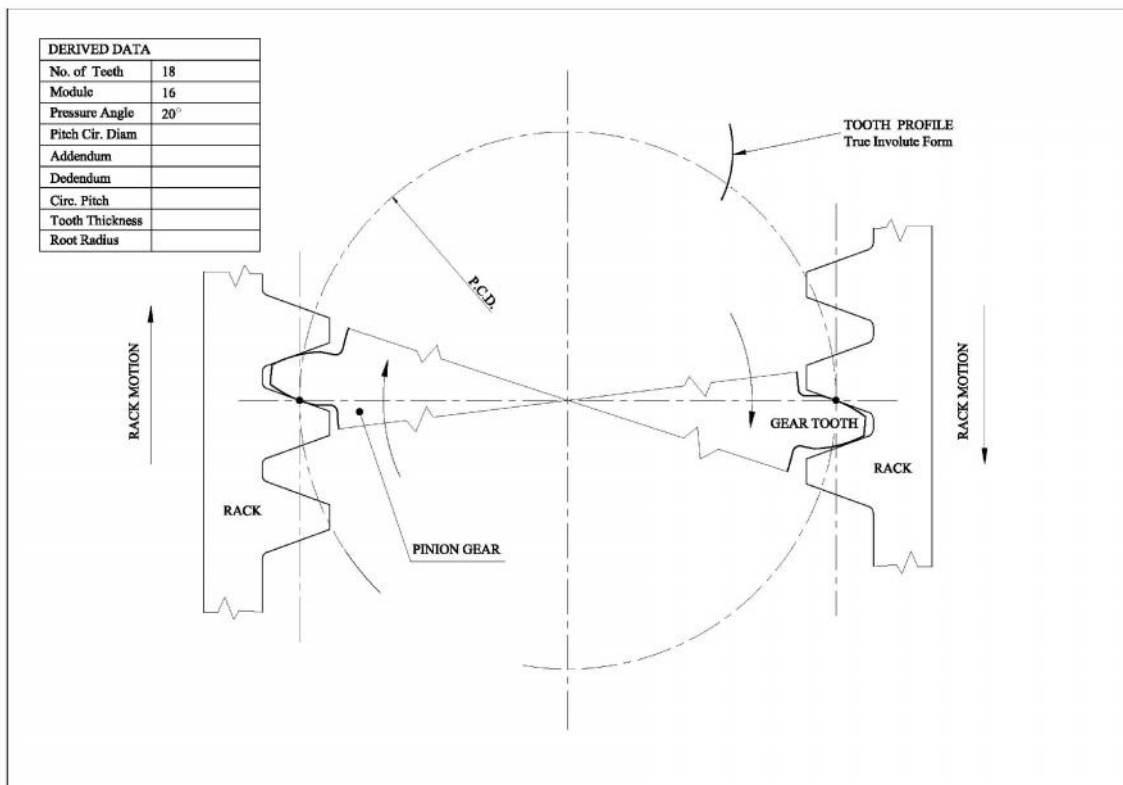
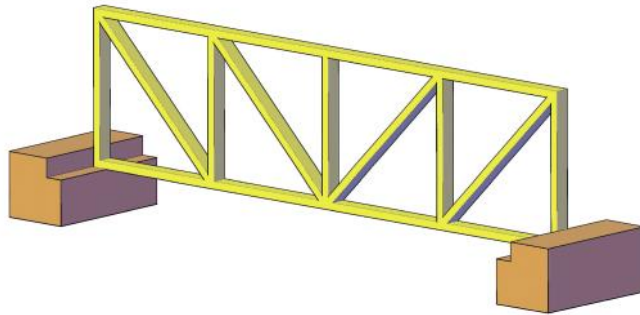


Figure 4a

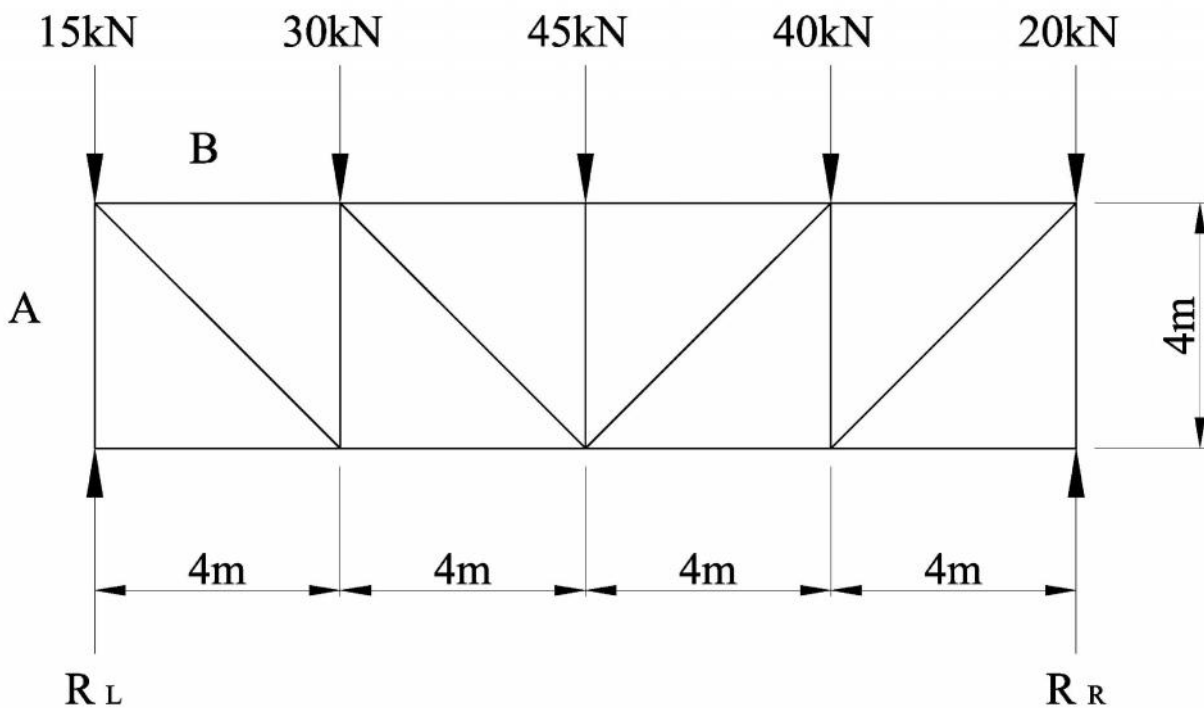
**Question 5**

The roof truss structure, shown on the right, is supported at ends  $R_L$  and  $R_R$ .



- a) Using a scale of 10mm representing 1m, draw the space diagram shown in Figure 5.
- b) Construct the force diagram by using a polar diagram and a link polygon. Use a scale of 10mm representing 10kN and present a clear notation system.
- c) Determine graphically and state the magnitude and direction of the reaction at  $R_L$  and  $R_R$ .
- d) State the magnitude and sense of the forces of the left hand half of the members distinguishing between struts and ties.

**(20 marks)**



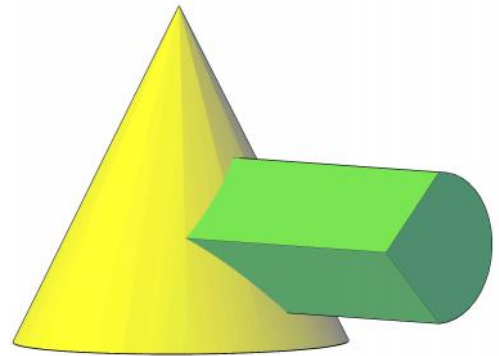
SPACE DIAGRAM

Figure 5

**Question 6**

An illustration of a right cone interpenetrated by a compound semi-cylinder and semi-square prism is shown. Incomplete orthographic views of the interpenetrating geometric solids are given in Figure 6.

- a) Draw full size, the given incomplete views together with a view in the direction of arrow A. Include all the curves of intersection and show all hidden details.
- b) Construct the surface development of half of the right cone, showing the opening of the semi-square prism and the semi-cylinder.



**(20 marks)**

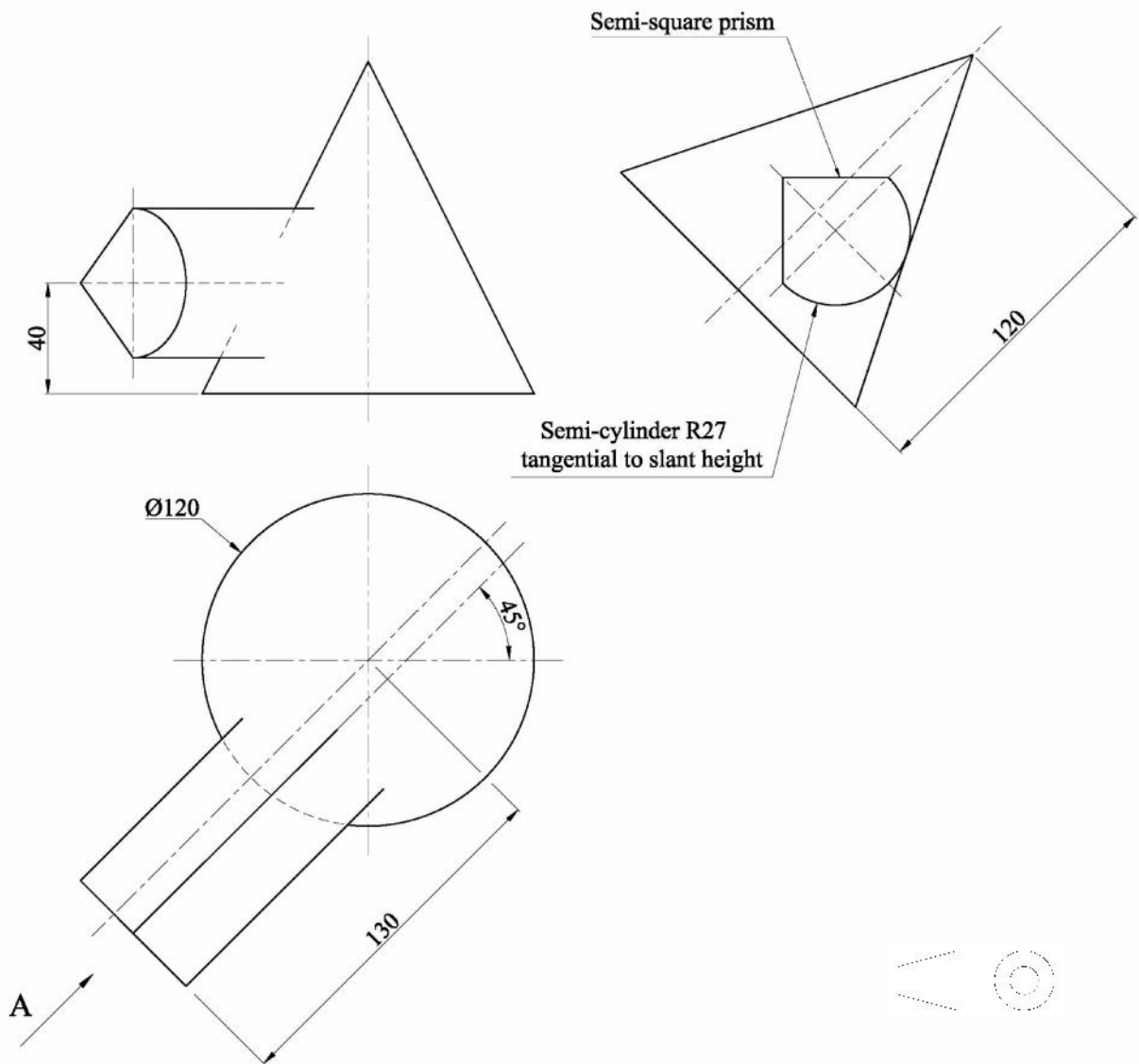


Figure 6

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<b>SUBJECT:</b>	GRAPHICAL COMMUNICATION
<b>PAPER NUMBER:</b>	II
<b>DATE:</b>	10 <sup>th</sup> 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.

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. all 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** (This question is compulsory)

The front view and the plan of a **split-level room** are shown in Figure 1. The lower level of the room is furnished with an L-shaped sofa, a carpet and a coffee table. During the day, this section of the room is lit by natural light by means of a window that opens into an internal shaft. The upper level of the room can be accessed by means of two steps. The upper section of the room leads to a corridor and a study area. This spot is furnished with a desk, which is placed beneath the second window, and two indoor plants in ceramic pots. Two paintings hang on opposite walls as indicated. The ceiling consists of lay-in square tiles mineral fibre panels and flash light fixtures.

The given views constitute an integral part of the design process, but fail to convey a feeling of the **3D** proportions of this room.

You are to meet this requirement by drawing a **single-point estimated perspective drawing**. The viewing direction required is indicated by the arrows at the bottom of the figure.

- i) Using **three** preliminary sketches, in rectangles 45mm x 30mm, explore alternative positions of the horizon line and identify the one which, in your opinion, best describes the spaciousness of the split-level room.  
**(3 marks)**
- ii) Based on your choice made in (i), produce the required illustration on a single side of an A2 size paper making the best use of the space available (the suggested floor tile size is 30mm).  
**(25 marks)**
- iii) Enhance your answer graphically using colours, tone and texture.  
**(6 marks)**

*You are not expected to apply colour/tone/texture to your whole illustration. You are advised to limit their use to a small area on each **different** item appearing in your illustration.*

**(34 marks total)**

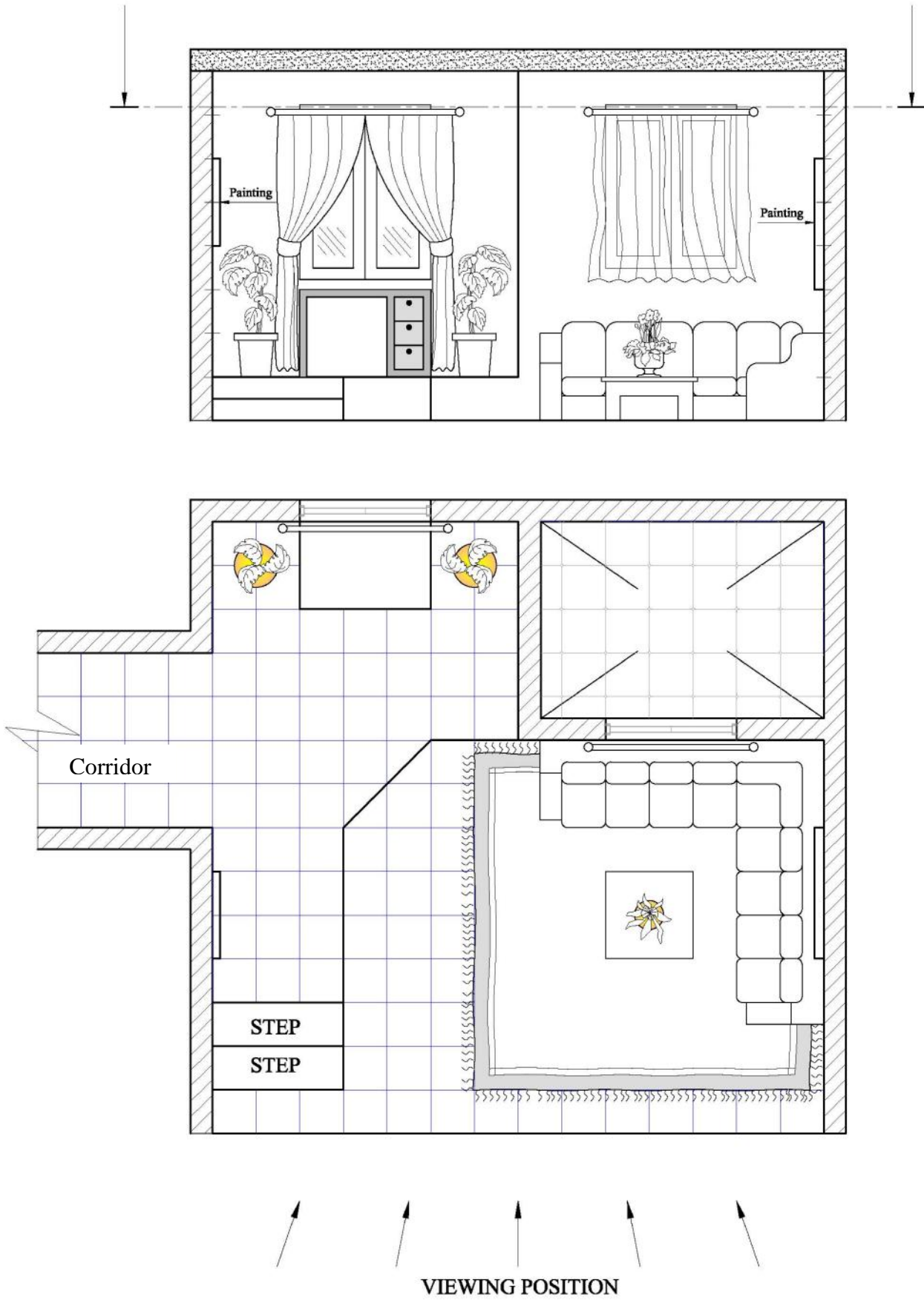



Figure 1

## Question 2

A catering company launched a logo competition advertised on the local newspapers and magazines. The design brief of the logo design is given below in Figure 2.



CATERING ADVERTS

**PRIME CATERING SERVICES** is an established food catering business specialising in wedding receptions. As part of our rebranding exercise, the management is launching a new **LOGO DESIGN COMPETITION**.

The design should portray a modern and professional service to our target audience consisting mainly of young couples. The logo, which has to be minimalist, memorable and instantly recognizable is to be composed of an arrangement of words and a symbol that signifies the brand image. The choice of font and colour is to be appropriate for a catering company. The logo has to be able to work on a wide range of items such as business cards, letterheads, brochures, website, mugs, T-shirts, shop signs and billboards.

Figure 2

You are requested to submit your work and break it down in the steps given below.

**a) Written analysis**

Identify, using keywords/short phrases, the main parameters of the brief. **(2 marks)**

**b) Graphical analysis**

Based on your response to (a), produce a series of preparatory sketches that illustrate your developing ideas. **(4 marks)**

**c) Graphical synthesis**

Clearly identify those elements produced in your sketches that you intend to use in the final image. **(2 marks)**

**d) Final realization**

Produce your final solution in a rectangle of suitable format. **(14 marks)**

**(22 marks total)**

### Question 3

Four orthographic views of a proposed hair dryer model are given in Figure 3. Since non-technical clients may find it difficult to interpret orthographic views, three-dimensional drawings or coloured sketches are usually produced. To improve the communication of the design idea, you are requested to:

- a) Draw at least two well-proportioned freehand **isometric sketches** of the hair dryer to display opposite viewing positions. **(14 marks)**
- b) Use your preferred drawing medium or media to colour and shade **one** of your sketches. **(8 marks)**

*Note: Marks will be awarded for proper use of colours to represent textures and forms.*

**(22 marks total)**

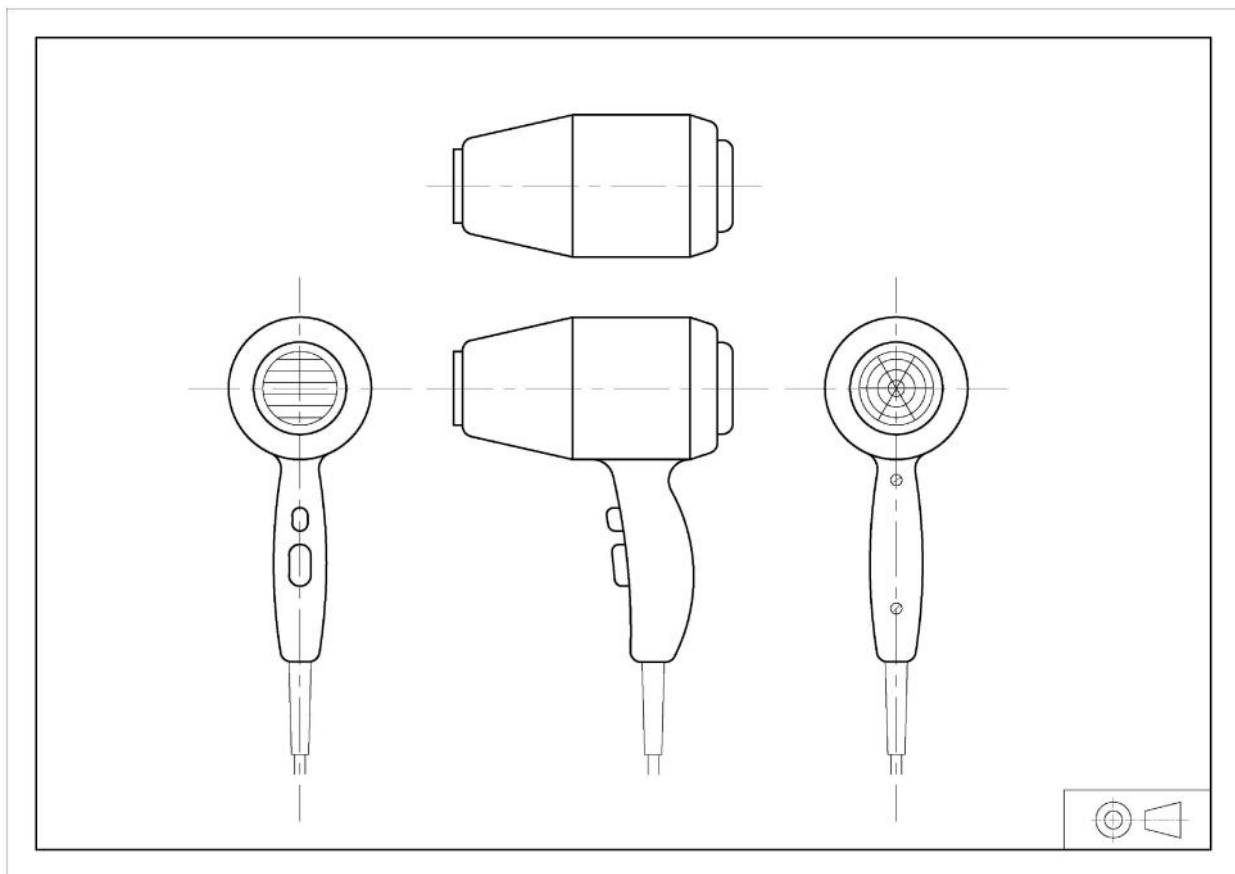


Figure 3

**Question 4**

Cyber bullying is the wilful and repeated harm inflicted through the use of computer, cell phones and other electronic devices. Most teens access social media sites and some of them fall victims of this cyber bullying phenomenon.

The following statistics indicate the gravity of this problem:

- One in six teenagers are cyber bullied.
- Girls are twice more likely to be bullied than boys.
- Only one in ten reaches out for help.

You are required to design an **infographic chart**, (see example of a typical infographic in Figure 4 a) to give a visual representation of the given data. A vague suggested format is given in Figure 4b.

Notes:

- Choose a suitable font for the title to match the subject.
- Print the given data.
- Integrate the text with your graphics.
- It is suggested that you use pictographs (see example in Figure 4a ) or any other forms of graphs to represent the data.
- Use the appropriate colours to match the subject and mood of this chart.

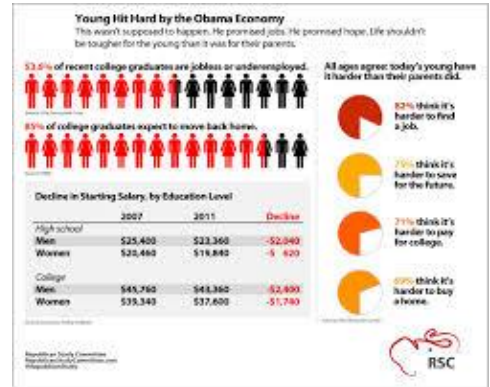


Figure 4a

(22 marks total)

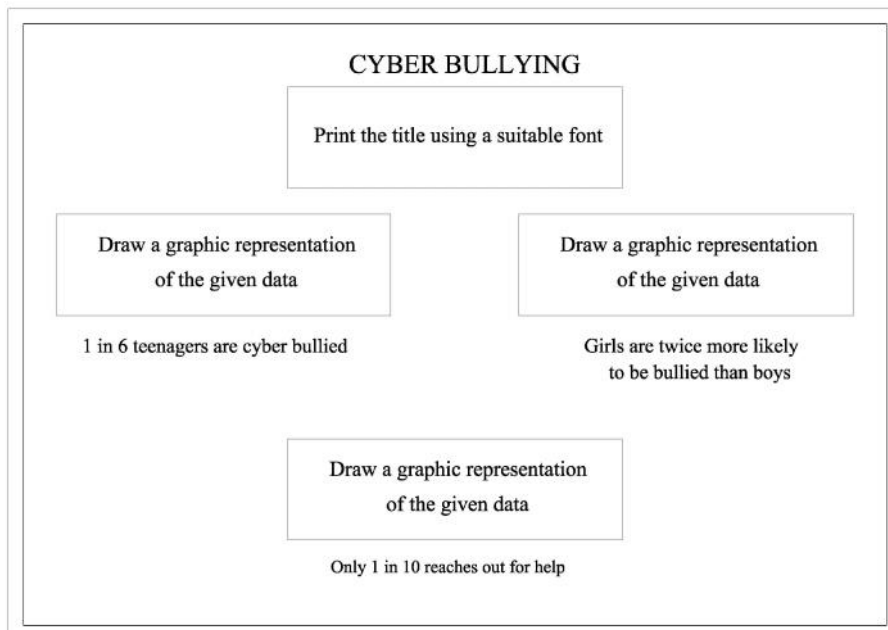


Figure 4b

### Question 5

When a graphic design is created, the typeface (lettering) selected can have a major impact on its success. The typeface, if chosen or designed correctly, reinforces the meaning of the words and the mood of the topic. In the posters shown below (Figure 5), the fonts chosen seem to match the mood of the promotion theme.



Figure 5

You have been asked to design a typeface which is suitable for a **Carnival Party** poster. Your work must be broken down in the steps given below, with each part being clearly identified.

i. **Written analysis**

After analysing the given posters, identify the characteristics of the typefaces and how these match the mood of the subject being communicated. **(3 marks)**

ii. **Brainstorming**

Write down keywords and short phrases related to the Carnival Party theme.

**(3 marks)**

iii. **Graphical analysis**

Based on your response to (i) and (ii), produce a number of sketches to explore different forms of typefaces that match best with the given theme.

**(4 marks)**

iv. **Graphical synthesis**

Clearly identify those elements produced in your response to (iii) that you intend to use in your final image and sketch a sample typeface.

**(2 marks)**

v. **Final realisation**

Produce the final work by using the typeface to print the words **Carnival Party**. Add suitable colours to enhance the appearance of the lettering and to set the appropriate mood.

**(10 marks)**

*Marks will be awarded for appropriateness of design and the proper use of colour.*

**(22 marks total)**

*End of examination paper*