

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD  
UNIVERSITY OF MALTA, MSIDA  
MATRICULATION EXAMINATION  
INTERMEDIATE LEVEL  
MAY 2015

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<b>SUBJECT:</b>	ENGINEERING DRAWING AND GRAPHICAL COMMUNICATION
<b>DATE:</b>	6 <sup>th</sup> May 2015
<b>TIME:</b>	4.00 p.m. to 7.00 p.m.

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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:

- 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 only **FOUR** questions from this section.

**Question 1**

A helical torsion spring has two straight arm ends as indicated in Figure 1a.

The spring is wound of round wire section and is represented in a semi-conventional manner in Figure 1b.

Draw, full size, an accurate construction of the torsion spring showing the helices formed by the wound spring wire.

*Do not include hidden detail.*

**(13 marks)**

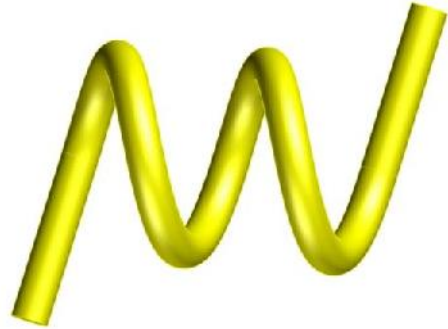


FIG. 1 a

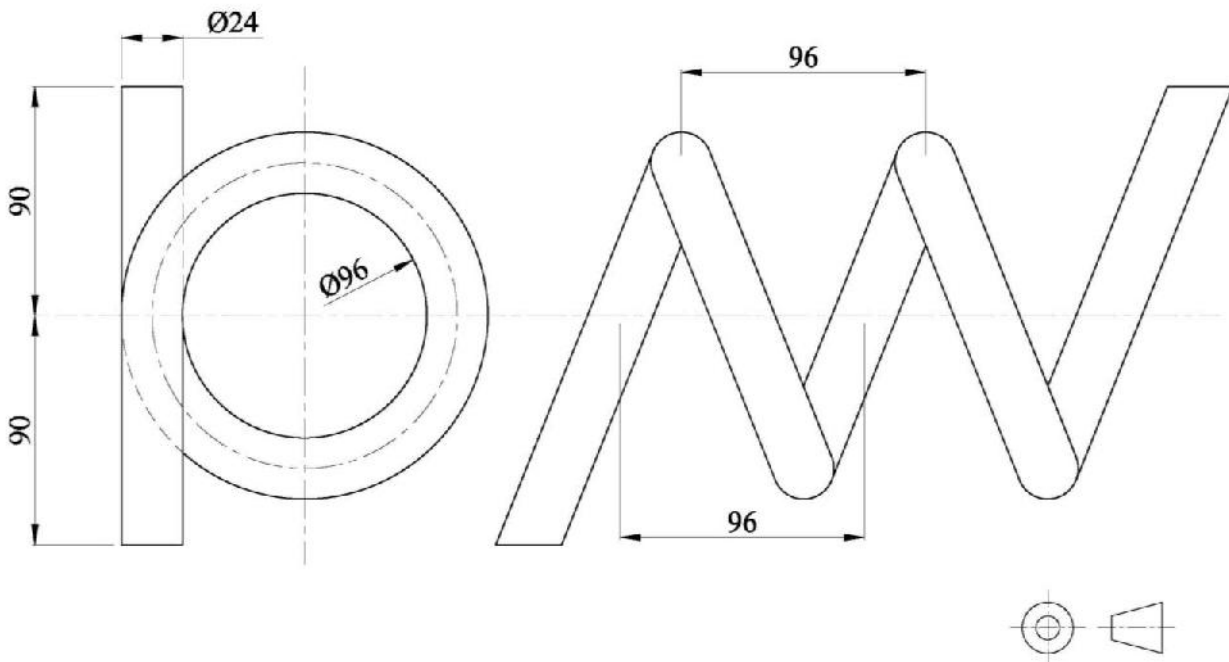


FIG.1b

**Question 2**

Figures 2a and 2b show three 100mm diameter spheres resting on the horizontal plane and in mutual contact with each other. A fourth sphere 50mm diameter is located above and touching all three 100mm diameter spheres.

Draw, full size:

- a) the front elevation shown in Figure 2b showing clearly how the points of contact of the spheres are found;
- b) a sectional plan passing through the three points of contact of the three 100mm diameter spheres and the 50mm diameter sphere.

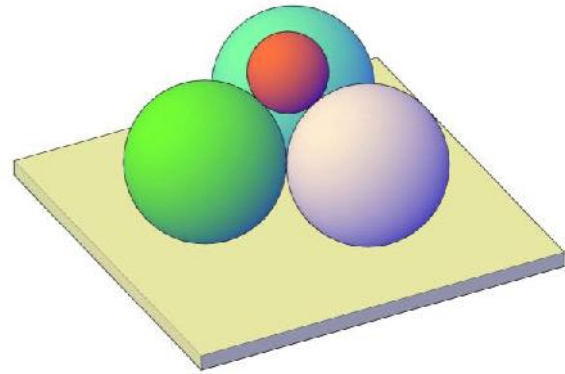


FIG. 2a

**(13 marks)**

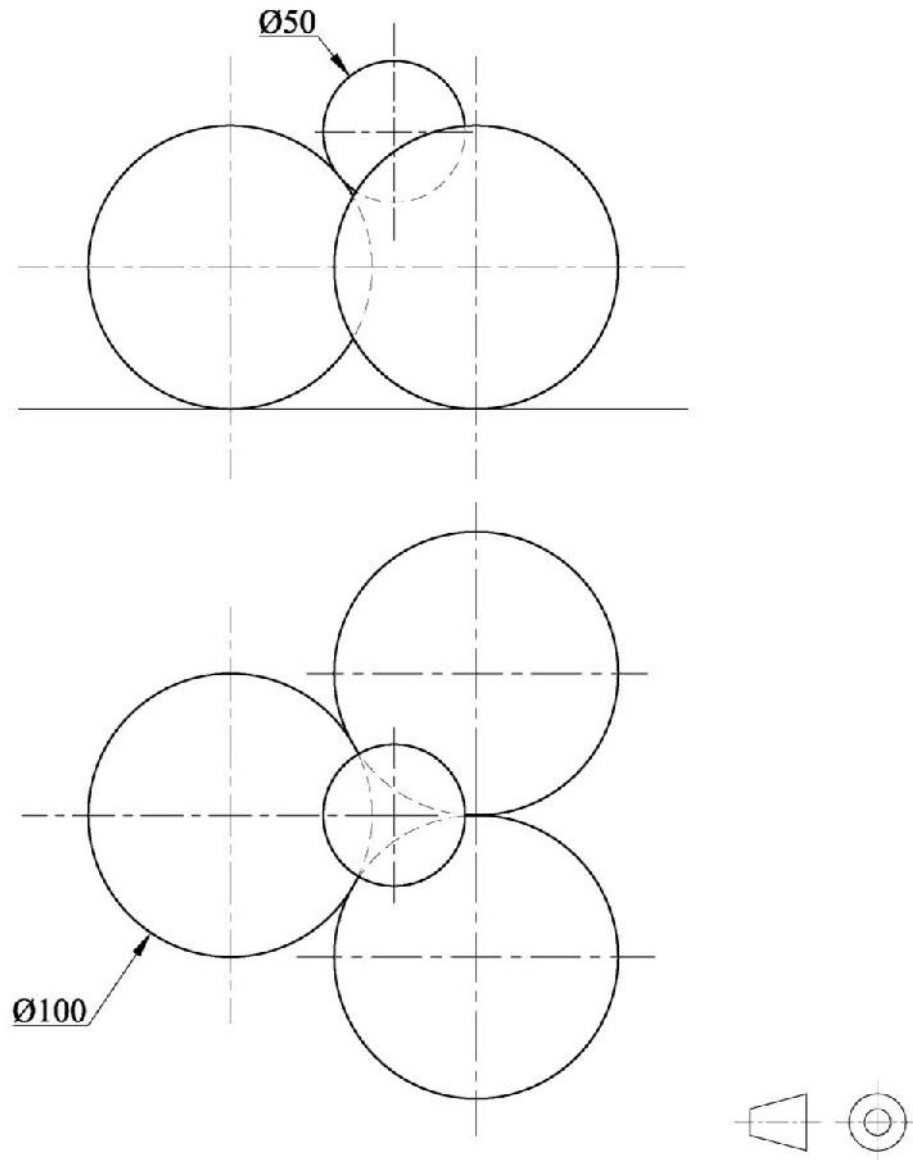


FIG. 2b

**Question 3**

A loaded beam five metres long is freely supported at one end at its extremity and at a point one metre from the other end. It carries a load of 180kN over its whole length together with a concentrated load of 60kN which is midway between the two reactions.

- a) Copy the space diagram using a scale of 30mm representing 1 metre and letter the spaces between the adjacent forces using Bow's notation.
- b) Using a scale of 10mm representing 12kN draw the force diagram for the forces and include a polar diagram.
- c) Determine graphically the:
  - i. shear force diagram;
  - ii. bending moment diagram;
  - iii. value of the left and right reaction;
  - iv. position along the beam where the bending moment is zero;
  - v. position of the greatest bending moment.

(13 marks)

SPACE DIAGRAM: Scale 30mm representing 1m

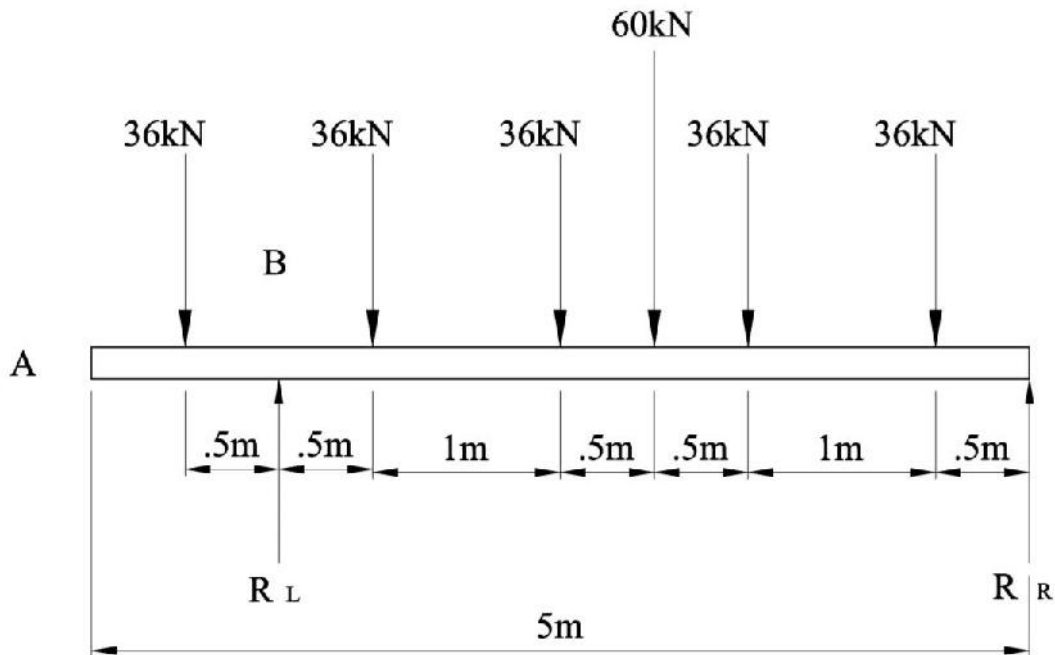


FIG. 3

**Question 4**

A rhombic prism is connected to a rectangular prism by the transition piece shown in Figures 4a and 4b.

- Copy full size the orthographic projection of the transition piece.
- Construct carefully the necessary true lengths.
- By means of triangulation, draw the surface development of the transition piece.

*Note: Place joint line along SS.*

**(13 marks)**

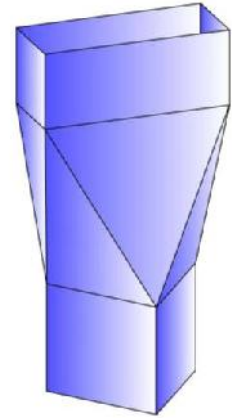


FIG. 4a

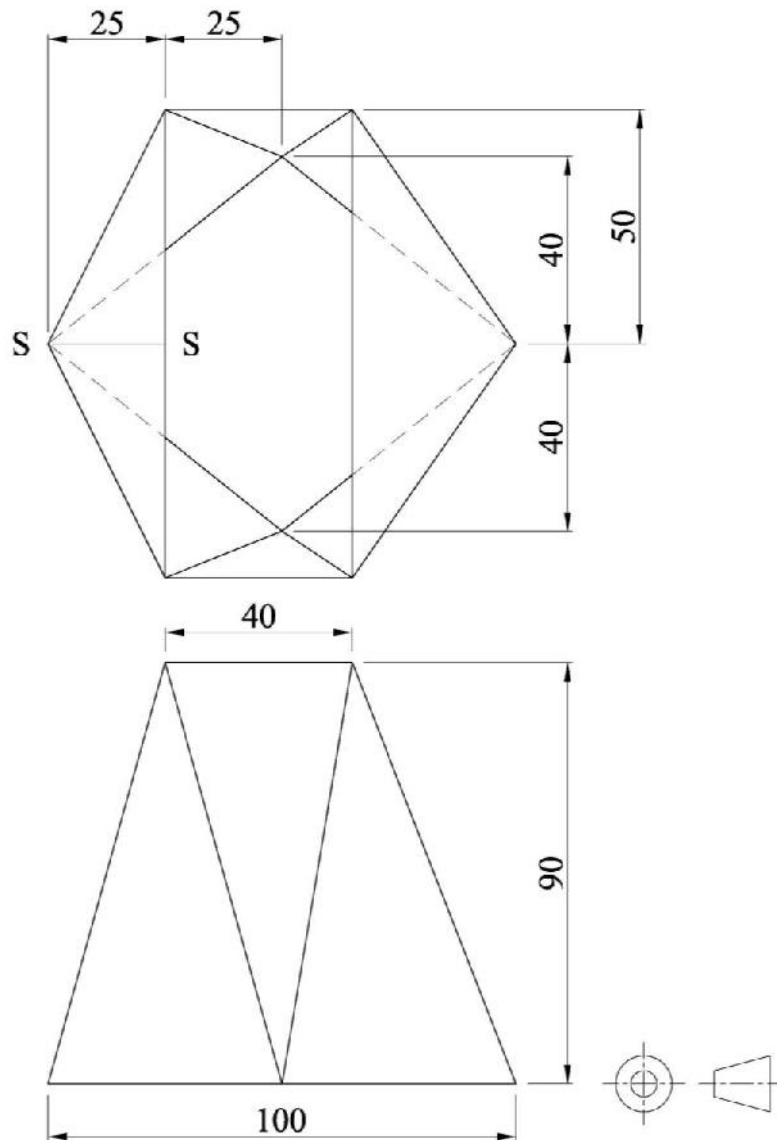


FIG. 4b

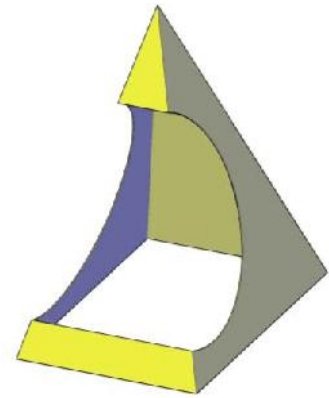
**Question 5**

A right rectangular pyramid is cut so as to accommodate and support an 80mm diameter cylinder as shown in Figures 5a and 5b.

Using the dimensions given in Figure 5b, draw:

- the auxiliary elevation;
- the complete plan showing the curve of intersection on the pyramid;
- the complete front elevation revealing the curve of intersection on the pyramid.

*Show hidden details.*



**(13 marks)**

FIG. 5a

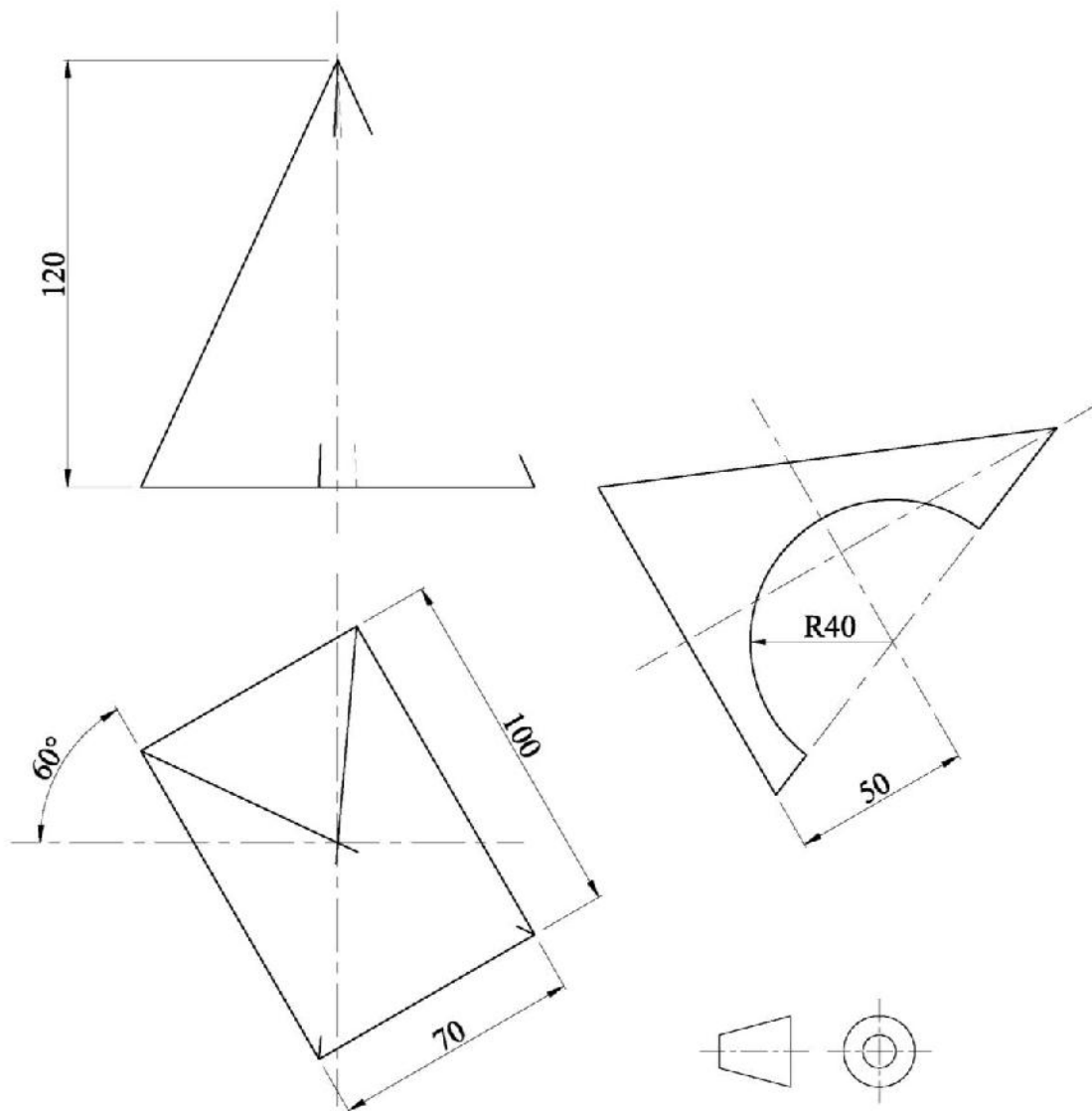


FIG. 5b

## SECTION B

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

### Question 6

An exploded view of a Flanged Shaft Coupling is shown in Figure 6a below.

The dimensioned details of the Flanged Shaft Coupling are attached and shown in Figure 6b on the A3 sheet.

The key (item 1) is fitted into the key slot recess of the shaft (item 2).

The half coupling (item 3) is fitted on the end of the shaft and located by means of the key.

The key (item 4), shaft (item 5) and half coupling (item 6) are assembled in a similar manner.

The half couplings are placed face to face with the spigot aligned in the socket, tightly fitted together and secured in position by means of four M20 bolts and nuts, (not shown), which transmit the load from one half coupling to the other.

Draw, full size,

- an end elevation;
- a sectional front elevation of the assembled coupling showing the shaft, keys, bolts and nuts in position. The section plane X-X passing through vertical centre-line of the coupling.

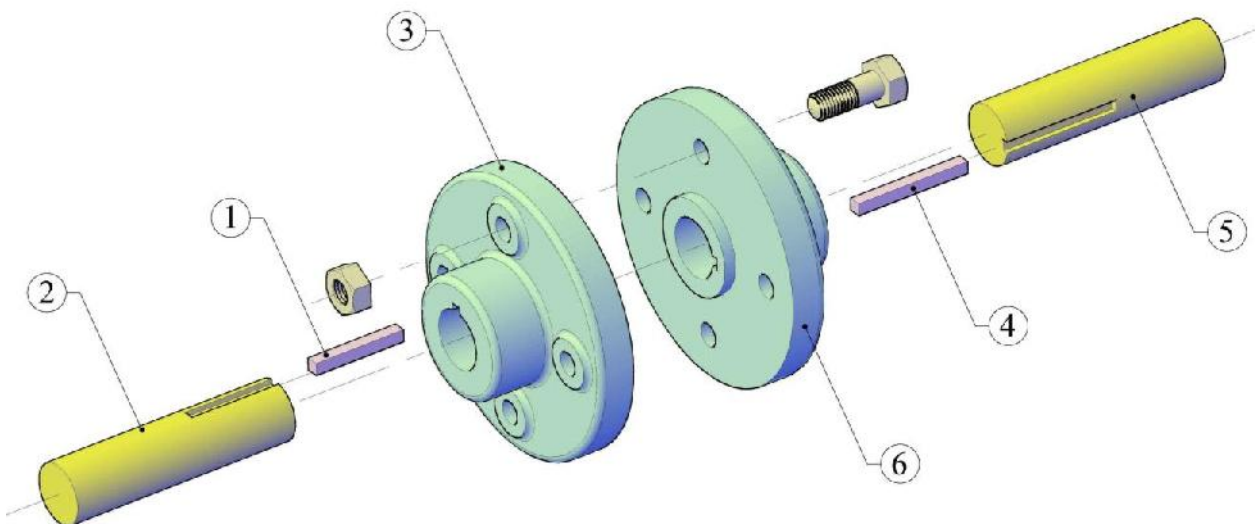
*Notes:*

*Show only one M20 bolt in position on the top (side) of the sectional elevation.*

*The hexagonal nut is to be drawn on the left hand side of the coupling.*

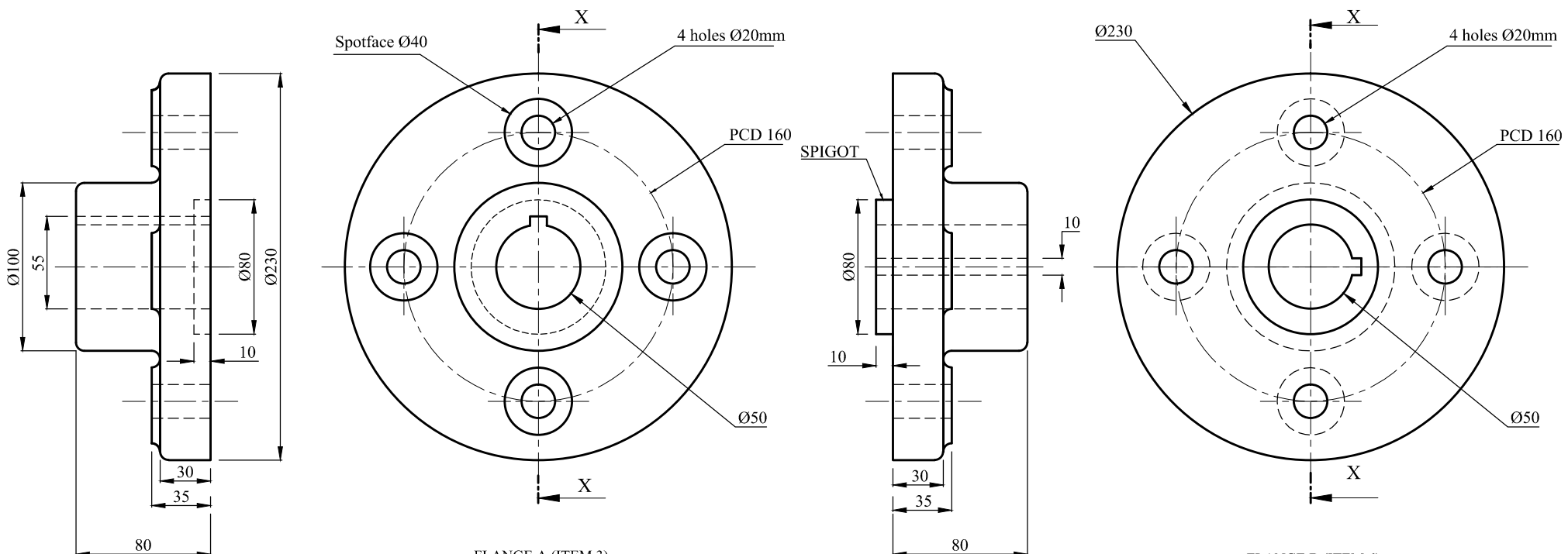
*Represent the key as a local section on the top half of the sectional elevation.*

**(24 marks)**



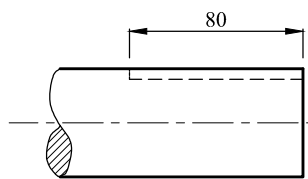
EXPLODED VIEW OF THE FLANGED SHAFT COUPLING

FIG. 6a

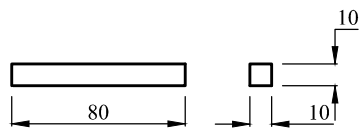
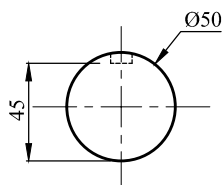


FLANGE A (ITEM 3)

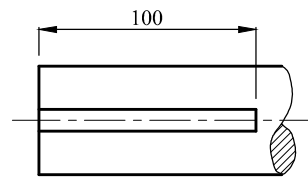
FLANGE B (ITEM 6)



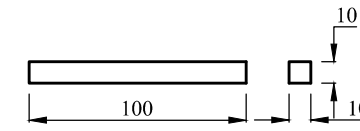
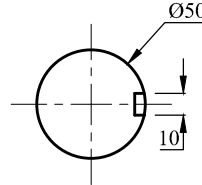
SHAFT A (ITEM 2)



KEY A (ITEM 1)



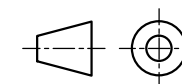
SHAFT B (ITEM 5)



KEY B (ITEM 4)

FILLET RADII 5mm unless otherwise stated

### FLANGED COUPLING





**Question 7**

As a general rule, all material cut by a sectioning plane is cross-hatched in orthographic views; however, there are exceptions to this rule.

A pictorial and two orthographic views of a crank are shown in Figures 7a and 7b respectively.

Draw a sectional isometric view of the crank showing how the view will be represented when the cutting plane:

- a) A-A passes longitudinally through the web, and
- b) B-B passes across the web of the crank.

*Do not show hidden detail.*

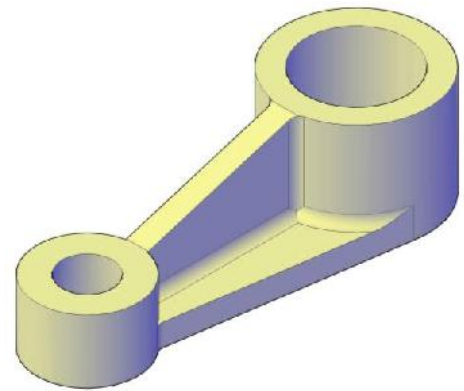


FIG. 7a

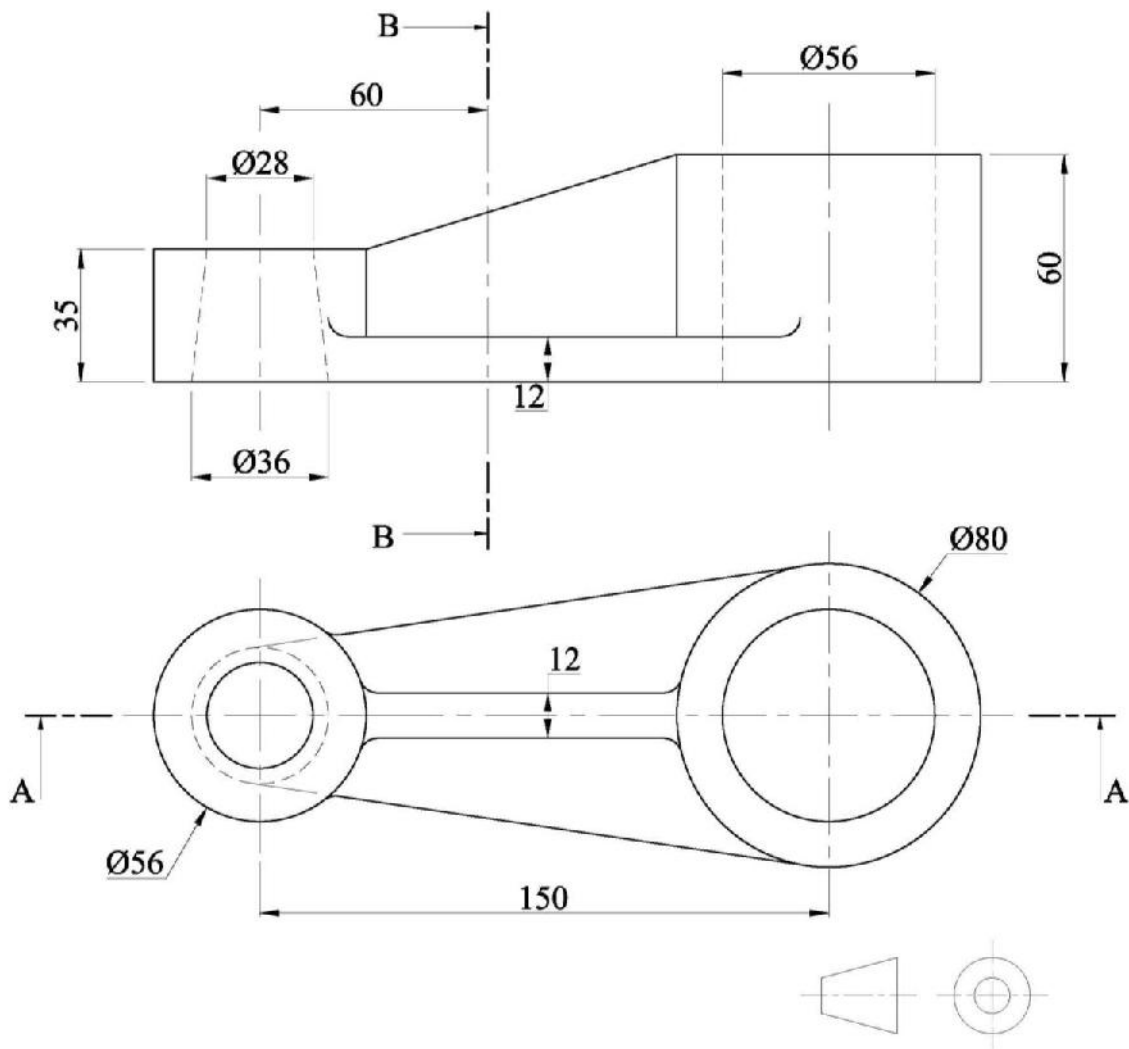


FIG. 7b

## SECTION C

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

### **Question 8**

Three orthographic views of a food mixer proposed design are given in Figure 8.  
Your task is to persuade the clients to buy the design by:

- a) drawing a well proportioned pictorial freehand sketch of the food mixer, and
- b) fully colouring and shading your drawing to make the product look attractive and consequently influence the target audience.

*Note: Pay particular attention to the representation of different materials and textures.*

**(24 marks)**

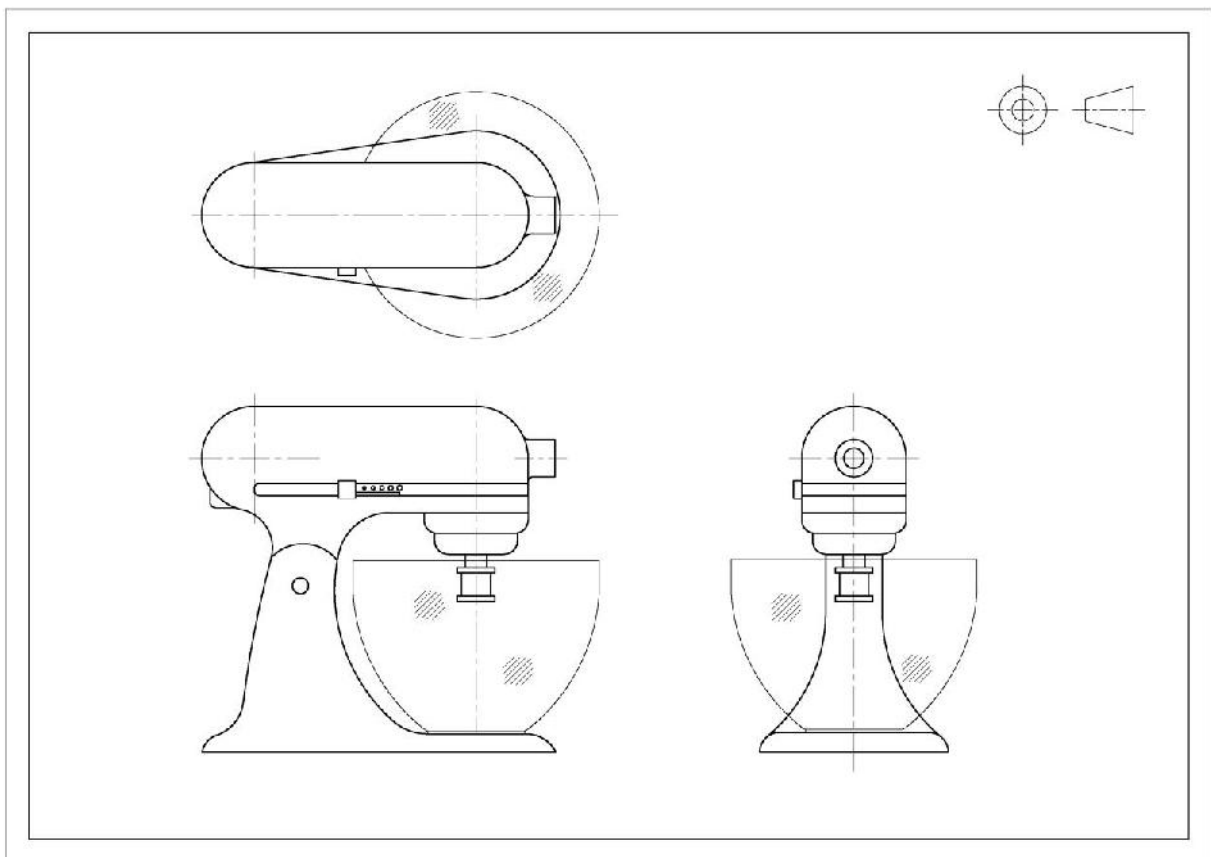


FIG. 8

### Question 9

The interior of a large room in a youth centre is to be redesigned to accommodate a catwalk event. The room measures 7.5 metres x 10 metres and is 5 metres high. A temporary stage and catwalk is to be built (detail of the proposed structure is shown in Figure 9a). Two flights of steps, one on each side of the catwalk, provide access to the stage. A U-shaped gypsum wall with three doorways is to be erected on the stage. Stage curtains are hung at the doorway to mask the backstage. A drop-down ceiling constructed directly above the catwalk is fitted with lighting fixtures appropriate for such an event.

The plan and front view of the project are shown in Figure 9b.

Using a scale of 30mm representing one floor tile, construct an estimated **single-point perspective** view of the planned room modification.

*Notes:*

- *The height of the courses is equal to the tile measurement.*
- *The viewing direction is indicated by the arrows at the bottom of Figure 9b.*
- *The suggested vanishing point is indicated in Figure 9b.*
- *Render small areas of different items in your solution.*

**(24 marks)**

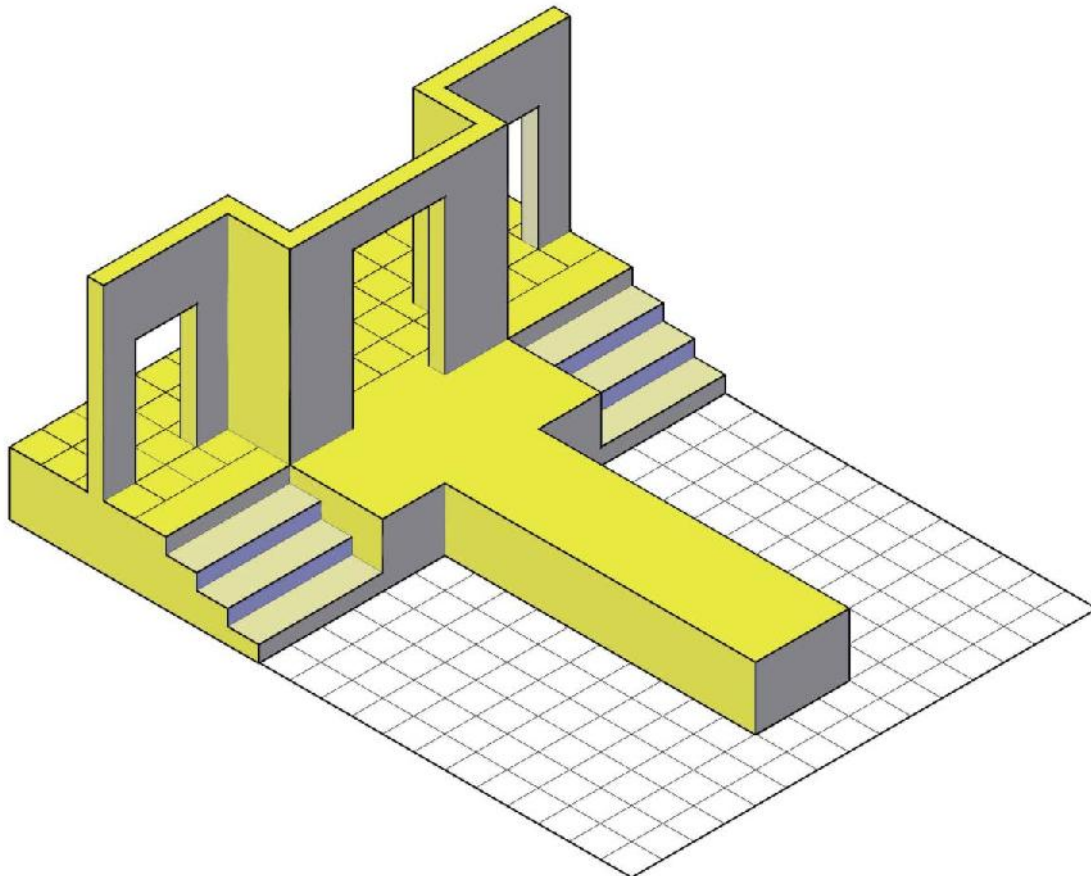


FIG. 9a

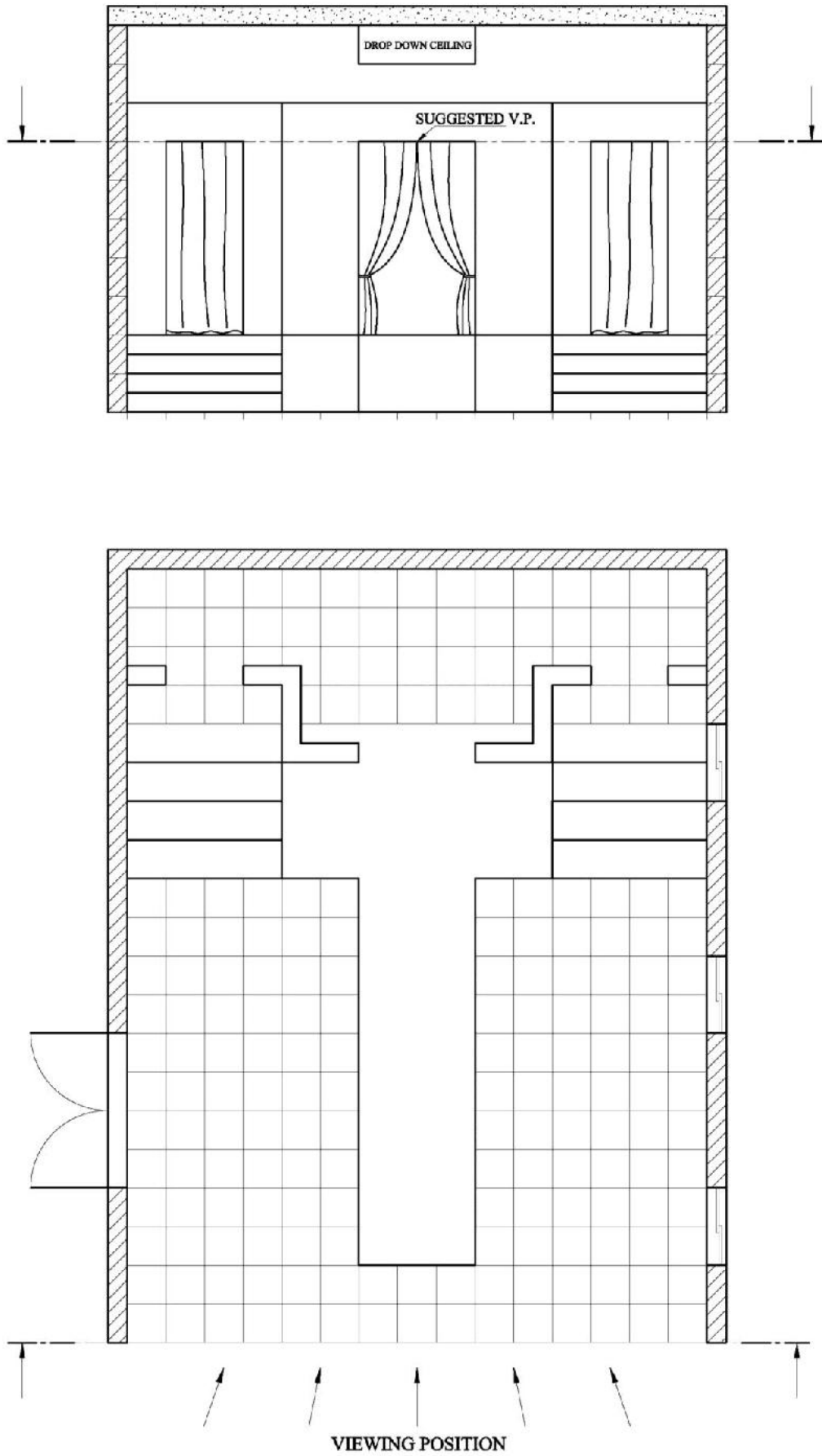


FIG. 9b