4.7 DRAWING AND DESIGN (449)

4.7.1 Drawing and Design Paper 1 (449/1)

SECTION A (50 Marks)

*Answer **all** the questions in this section on the A4 sheet provided.*

1. (a) State **four** ways of caring for the drawing instruments. (2 marks)

(b) Name **two** types of lines used in technical drawing and state where each is applied. (2 marks)

2. Explain the use of each of the following in drawing:

(a) Sketches

(b) Assembly drawings

(c) Exploded views

(d) Working drawings (4 marks)

3. (a) State **three** factors to consider when choosing materials for engineering works. (3 marks)

(b) Explain the meaning of the term **"alloy"** as applied in materials and give **two** examples. (2 marks)

4. (a) State **two** reasons for using symbols and abbreviations in drawing. (2 marks)

(b) Draw the symbols representing each of the following welded joints:

(i) Fillet

(ii) Double-Vee butt (2 marks)

5. (a) Use sketches to show **four** ways of dimensioning arcs in drawing. (2 marks)

(b) Use a cuboid to illustrate the difference between oblique projection and one point perspective projection in drawing. (2 marks)

6. **Figure 1** shows a shaped block drawn in isometric projection.

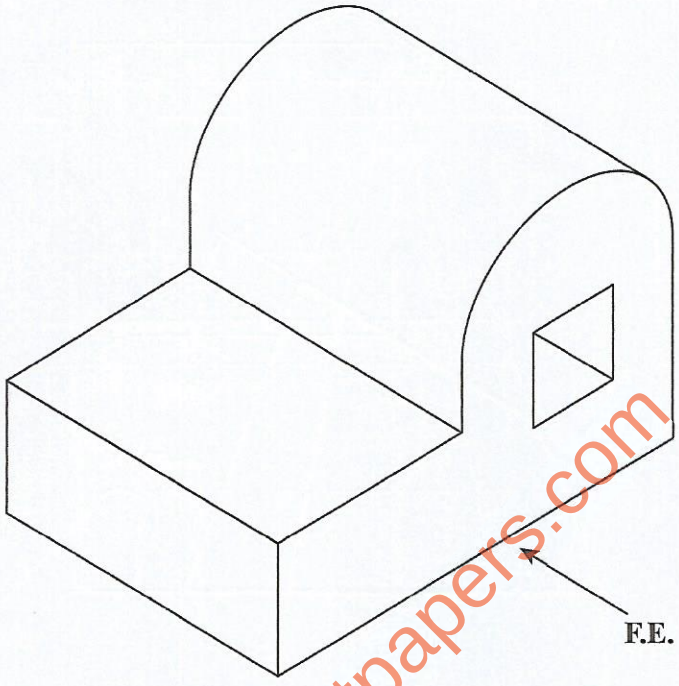

Figure 1

Sketch in good proportion the three orthographic views of the block in third angle projection. (6 marks)

7. (a) Explain the meaning of each of the following scales in relation to the size of the drawing and the actual object: (2 marks)

(i) 1:50

(ii) 50:1

(b) Construct a parallelogram whose two opposite sides are 65 and 40 given that the angle between two adjacent sides is 60°. (5 marks)

8. **Figure 2** shows the front elevation of a truncated hexagonal pyramid. Draw the given view and complete plan in first angle projection. (5 marks)

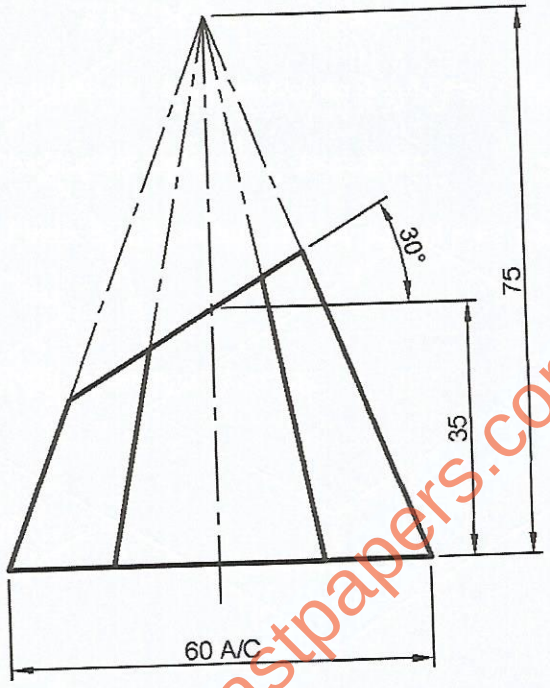

Figure 2

9. (a) Write each of the following abbreviations in full as used in computer applications:

(i) CAM

(ii) CAD (2 marks)

(b) **Figure 3** shows views of the two parts of a machine component drawn in first angle projection.

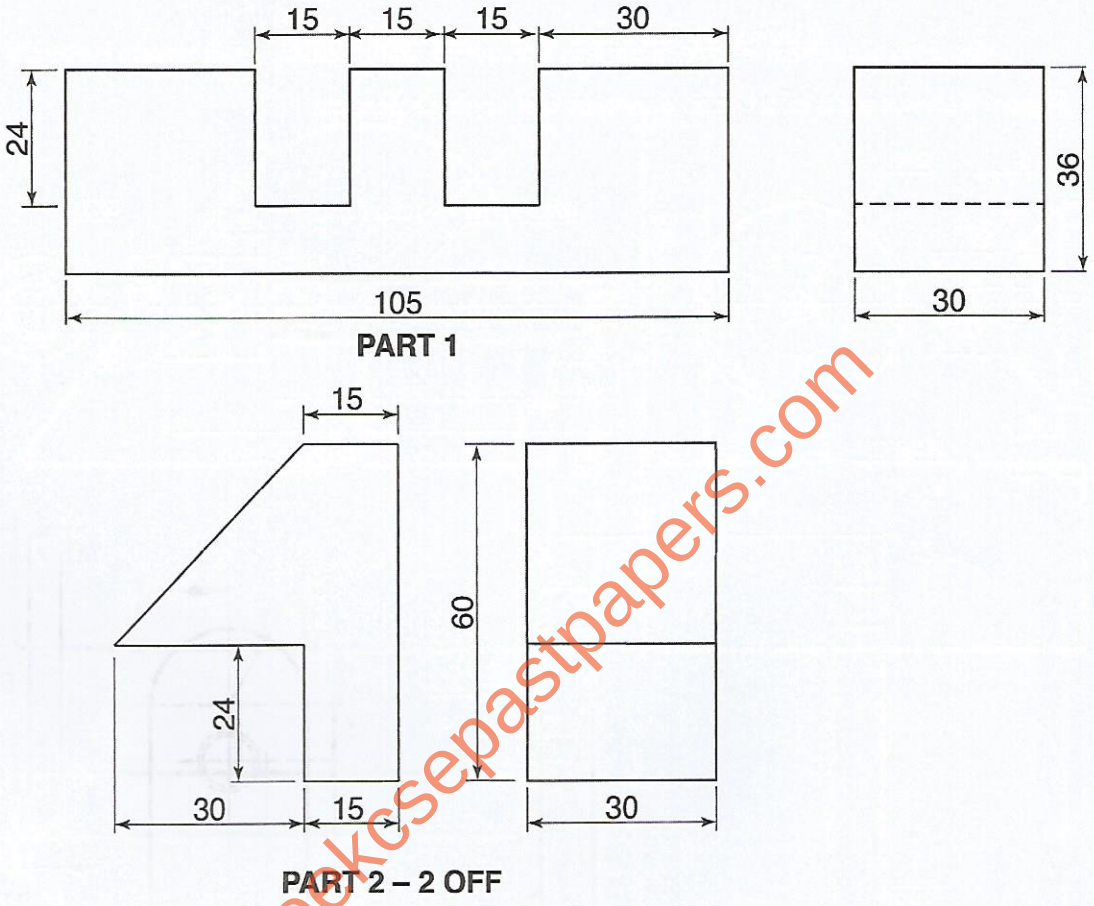

Figure 3

Assemble the parts and sketch the component in oblique projection with A as the front face.

(6 marks)

10. Explain the importance of each of the following in the design process:

(a) Research

(b) Evaluation (3 marks)

SECTION B (20 Marks)

*This question is **compulsory**.*

*It should be answered on the **A3 paper provided.***

11. **Figure 4** shows parts of a clamp drawn in first angle projection.

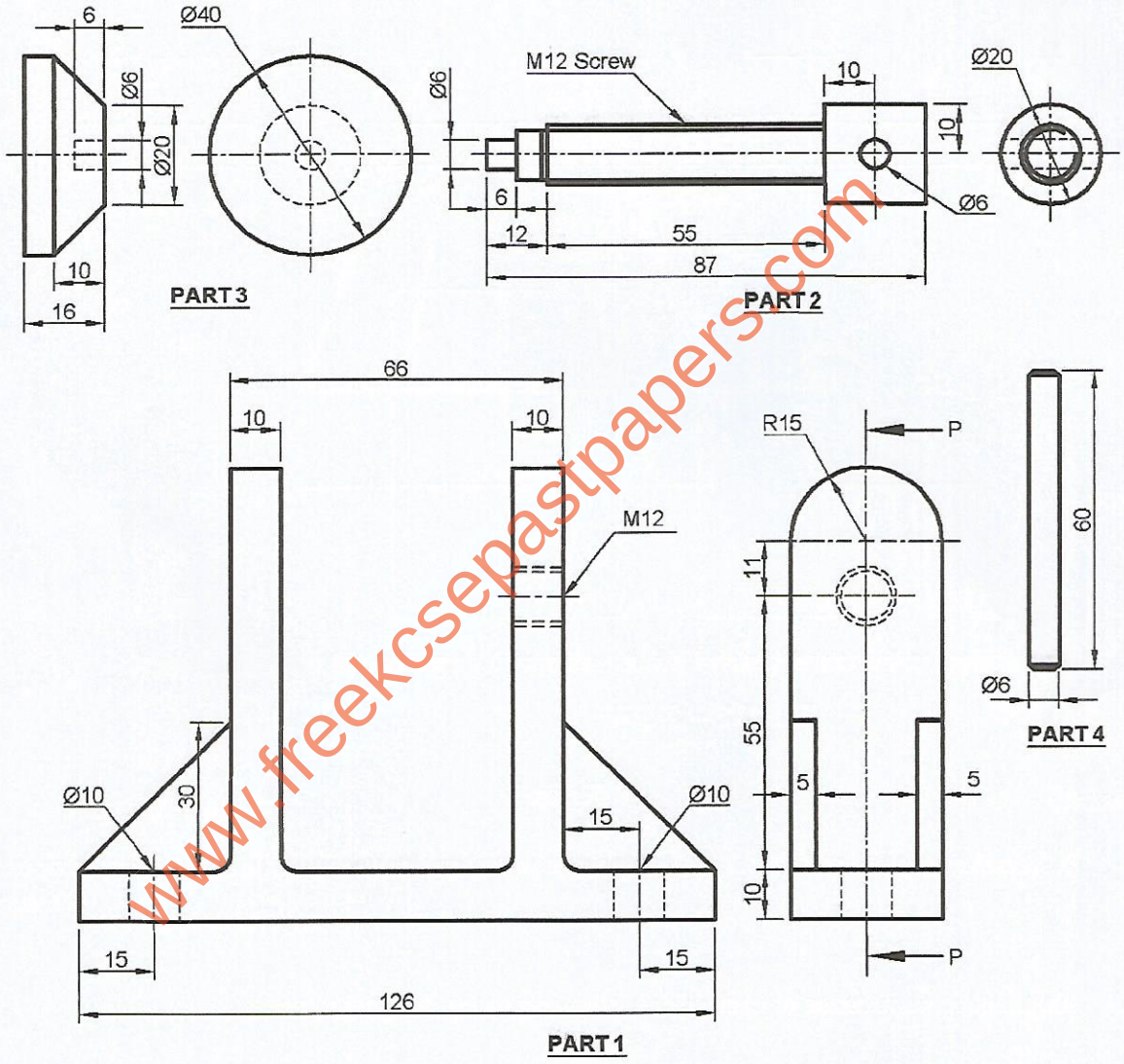

Figure 4

Assemble the parts and draw **Full Size** the following in third angle projection:

(a) Sectional front elevation along the cutting plane P - P

(b) Plan

Unspecified dimensions are left to the candidates discretion. (20 marks)

SECTION C (30 Marks)

*Answer any **two** questions from this section on the **A3** paper provided.*

12. **Figure 5** shows three orthographic views of a casting drawn in first angle projection.

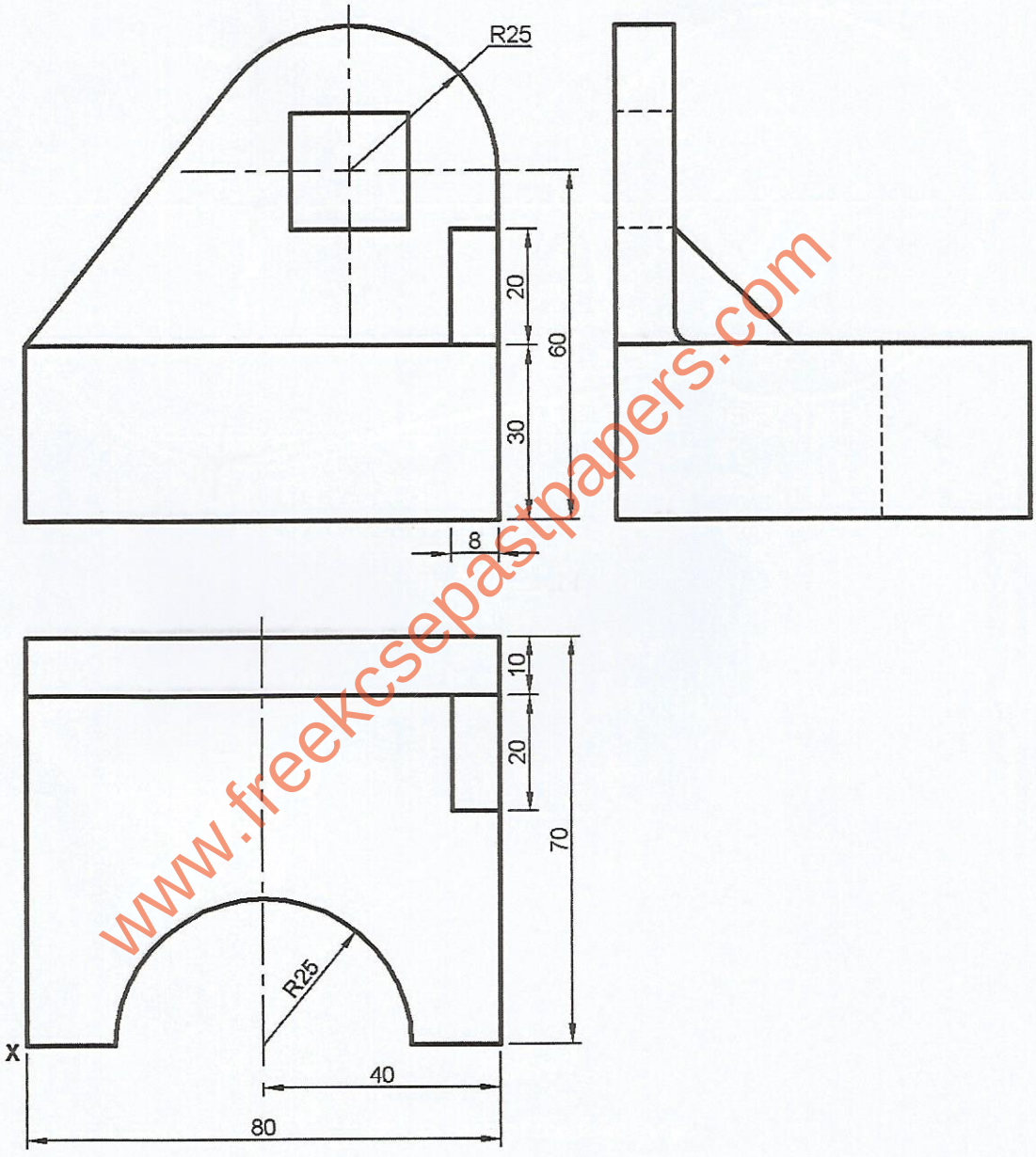

Figure 5

Draw the casting in isometric projection taking corner **X** as the lowest point. (15 marks)

13. In the mechanism shown in **Figure 6**, the crank EF rotates about centre E while GH oscillates about G. Plot the locus of the point P for one complete revolution of EF. (15 marks)

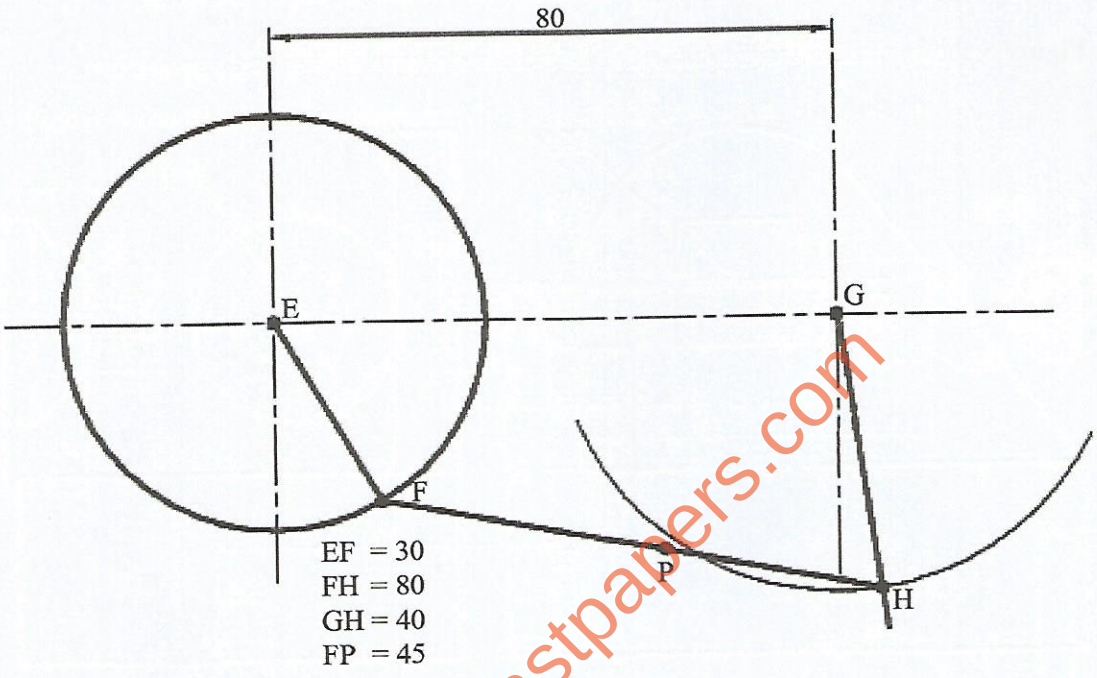

Figure 6

14. **Figure 7** shows two intersecting square tubes A and B drawn in 1st angle projection.

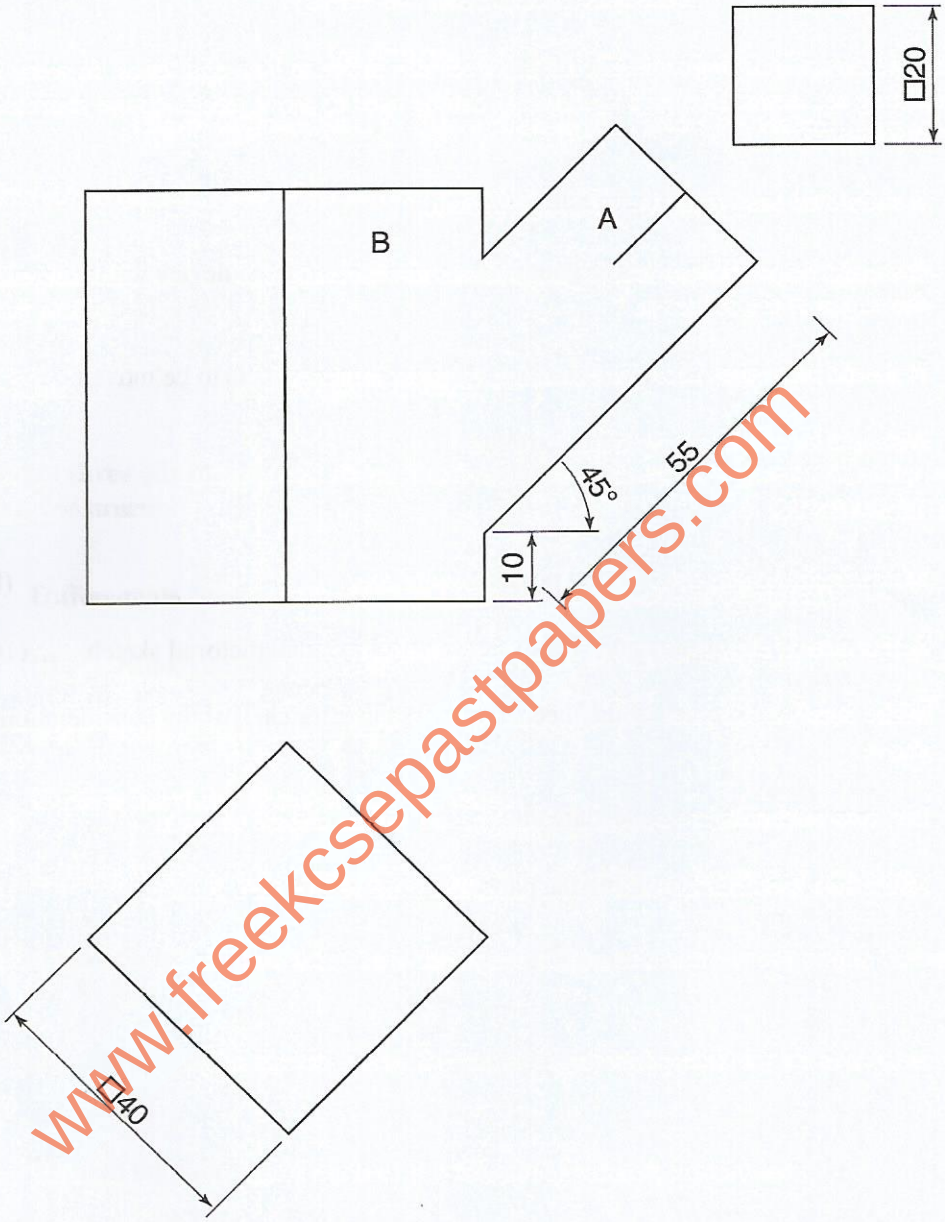

Figure 7

(a) Copy the figure and complete each of the following:

(i) Front elevation

(ii) Plan

(b) Draw the development of tube B. (15 marks)

4.7.2 Drawing and Design Paper 2 (449/2)

DESIGN PROBLEM (40 marks)

Moving goods upstairs in buildings without lift facilities can prove to be a challenge. In some cases, this ends up causing accidents. Design a trolley that can be used to move goods up the staircase considering the following:

1. It should be easy to move on a level ground.
2. It should be possible to move goods on a staircase using the device without damaging the edges of the staircase.
3. It should have provision for extension to allow larger parcels to be moved.
4. It should have a firm grip on the ground.

REQUIREMENTS

(a) Make freehand sketches of **two** possible solutions. (8 marks)

(b) Select **one** of the designs in (a) above and make a refined pictorial sketch. (10 marks)

(c) Make detailed sketches of the mechanisms to allow for each of the considerations 1 to 4 above. (14 marks)

(d) List **two** materials used and state **one** reason for the choice of each. (4 marks)

(e) Name **two** methods of joining the parts and state where each is used. (4 marks)

4.8 AVIATION TECHNOLOGY (450)

4.8.1 Aviation Technology Paper 1 (450/1)

SECTION A (44 marks)

*Answer **all** questions in this section in the spaces provided.*

1. Outline **three** general roles of an aeronautical engineer. (3 marks)

2. Outline **four** factors to consider when determining the location of fire extinguishers in an aircraft hanger. (4 marks)

3. State **four** categories of the Kenyan airspace. (2 marks)

4. Highlight **three** advantages and **three** disadvantages of using composites as materials for aircraft construction. (3 marks)

5. (a) Differentiate between each of the following classification of aircraft:

(i) Autogyro and helicopter (2 marks)

(ii) Glider and ornithopter (2 marks)

(b) Explain the **three** types of parasite drag. (3 marks)

(c) Explain **four** contributions of Sir George Cayley to the history of Aviation. (2 marks)

6. With the aid of a labelled sketch, show the construction of a semi-monocoque fuselage design. (4 marks)

7. With the aid of a labelled sketch, show the battery ignition system for an aero piston engine. (6 marks)

8. (a) Explain the function of each of the following aircraft instruments:

(i) Machmeter (1 mark)

(ii) Turn and slip indicator (1 mark)

(iii) Artificial horizon (1 mark)

(b) Explain **two** sources of fuel contamination. (2 marks)

9. Describe each of the following heat treatment processes: (4 marks)

(i) Hardening

(ii) Tempering

(iii) Annealing

(iv) Normalising

10. Describe each of the following types of lines and state where each is used in engineering drawing: (4 marks)

(a) Construction line

(b) Centre line

(c) Extension line

(d) Leader line

SECTION B (56 marks)

*Answer any **four** questions from this section.*

11. **Figure 1** shows the front elevation of a truncated cone, cut along plane G–G. On the **A3** paper provided, draw **full size** the following views in 1st angle projection:

(a) Front elevation

(b) End elevation in the direction of arrow Y

(c) Plan

(14 marks)

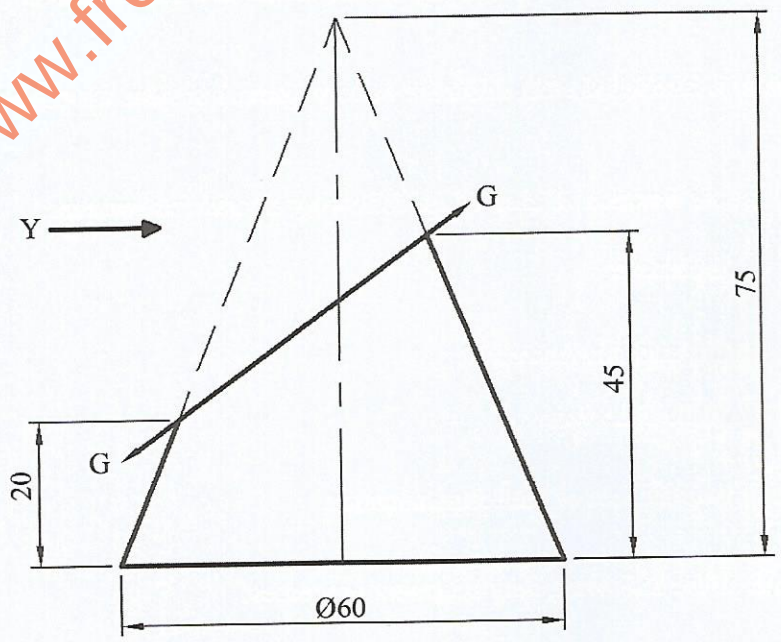

Figure 1

12. (a) Use sketches to show **six** types of wing shapes used on various aircrafts. (6 marks)

(b) **Figure 2** shows a typical aircraft basic hydraulic system. Name the components labelled 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10. (5 marks)

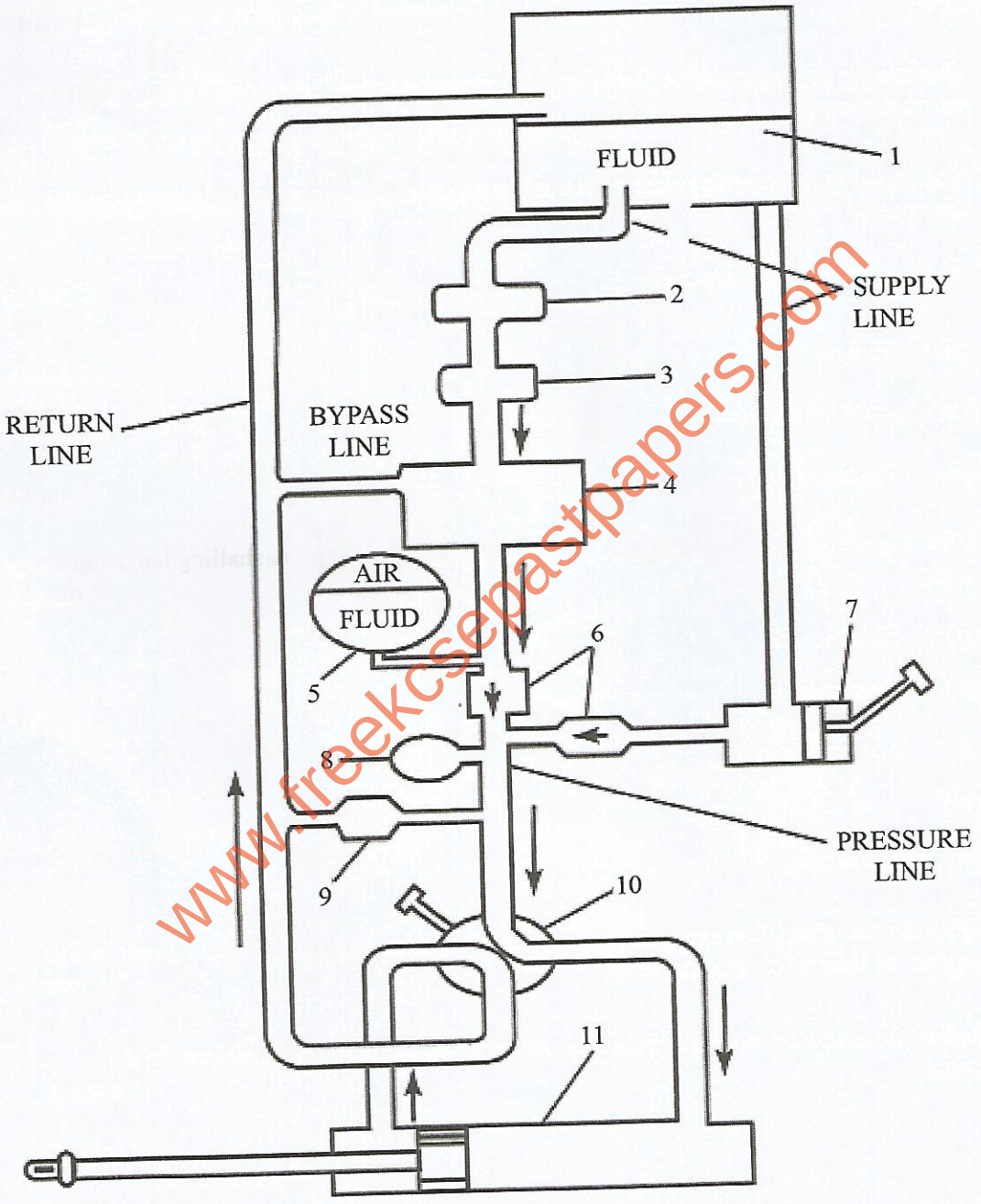

Figure 2

(c) Describe the functions of each of the following auxiliary flight control surfaces: (3 marks)

(i) Winglets

(ii) Vortex generators

(iii) Stall fence

13. With the aid of a labelled cross-sectional sketch, explain the operational cycle of a pure jet axial flow engine. (14 marks)

14. (a) Outline the procedure of performing a dye penetrant non-destructive testing on an aircraft component. (6 marks)

(b) State **four** ways in which each of the following human factors induced errors can be reduced:

(i) Lack of communication (2 marks)

(ii) Fatigue (2 marks)

(iii) Lack of knowledge (2 marks)

(iv) Distraction (2 marks)

15. (a) With the aid of labelled sketches, show each of the following marshalling hand signals at night: (5 marks)

(i) Hold/Standby

(ii) Stop engines

(iii) Normal stop

(iv) Turn left

(v) Turn right

(b) With the aid of labelled sketches, differentiate between the trim tab and balance tab as applied to aircraft control surfaces. (5 marks)

(c) Outline the first aid procedure given to a person to treat a burn or scalp injury in the hangar. (4 marks)