3.21 DRAWING AND DESIGN (449)

3.21.1 Drawing and Design Paper 1 (449/1)

SECTION A (50 marks)

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

1. (a)   Distinguish between technical drawing and artistic drawing.   (2 marks)

    (b)   State **two** career opportunities available after studying drawing and design in
          secondary school.   (2 marks)

2. Give **two** reasons for using each of the following: (2 marks)

    (a)   Platics in making set squares.

    (b)   Blockboard in making drawing boards.

3. (a)   Distinguish between a salary and a wage.   (2 marks)

    (b)   **Figure 1** shows an elevation of a shaped block. Name the lines labelled **A**, **B**, **C** and **D**.
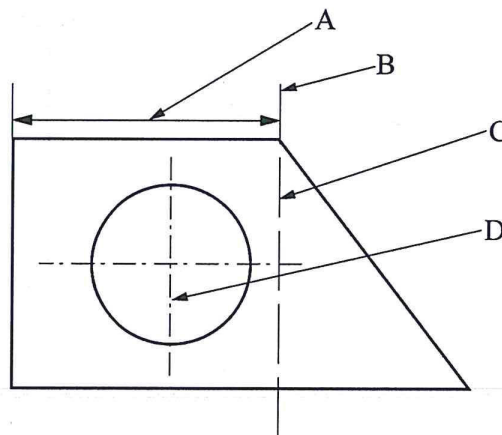   (2 marks)

Figure 1

4. (a)   Using the concentric circles method, construct an ellipse whose major axis is 80 mm
          and minor axis is 60 mm.   (5 marks)

5. (a)   Define the following properties of materials: (3 marks)

    (i)   Ductility

    (ii) Malleability

(b) Define the following terms as used in drawing: (3 marks)

(i) Linear mesurements.

(ii) Angular measurements.

(iii) Scales.

6. (a) State **four** ways through which design ideas are communicated. (2 marks)

(b) Name **two** components which can be used to store drawings in soft copy externally.
(1 mark)

7. Construct a diagonal scale on which 25 mm represent 1 m to read upto 5 m. Indicate a reading of 3.68 m on the scale. (6 marks)

8. **Figure 2** shows a truncated hexagonal prism resting on one of its sides. Draw the end elevation of the prism and the true shape of the cut face. (6 marks)
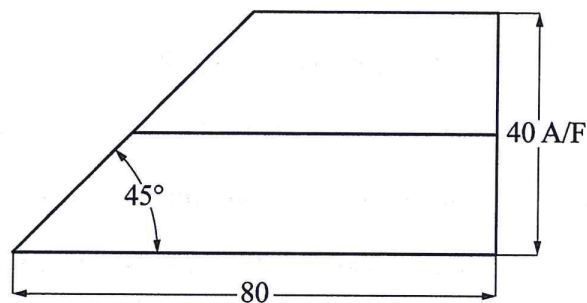

Figure 2

9. (a) Use sketches to illustrate the following type of sections: (4 marks)

(i) Revolved section.

(ii) Staggered section.

(b) With the aid of a sketch of a cube distinguish between one point perspective and two point perspective drawings. (3 marks)

10. **Figure 3** shows three views of a block drawn in first angle projection. In good proportion, draw the block in isometric projection with X as the lowest point (7 marks)

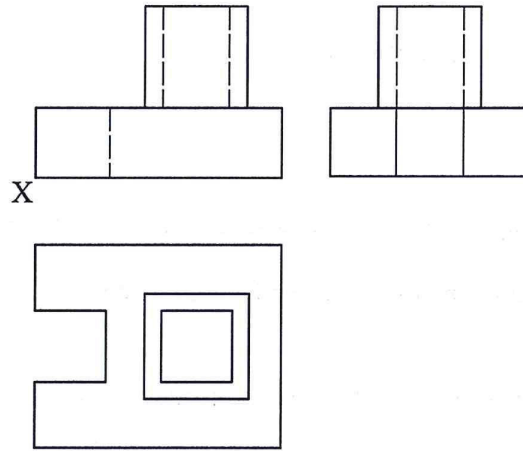
Figure 3

SECTION B (20 marks)

*This question is **compulsory**.*

It should be answered on the A3 paper provided.

*Candidates are advised **not to spend more than one hour** on this question.*

11. **Figure 4** shows parts of a pulley support bracket drawn in third angle projection.

PART 1 – BRACKET

PART 2 – PIN

PART 3 – BUSH

PART 4 – PULLEY

PART 5 – GRUB SCREW
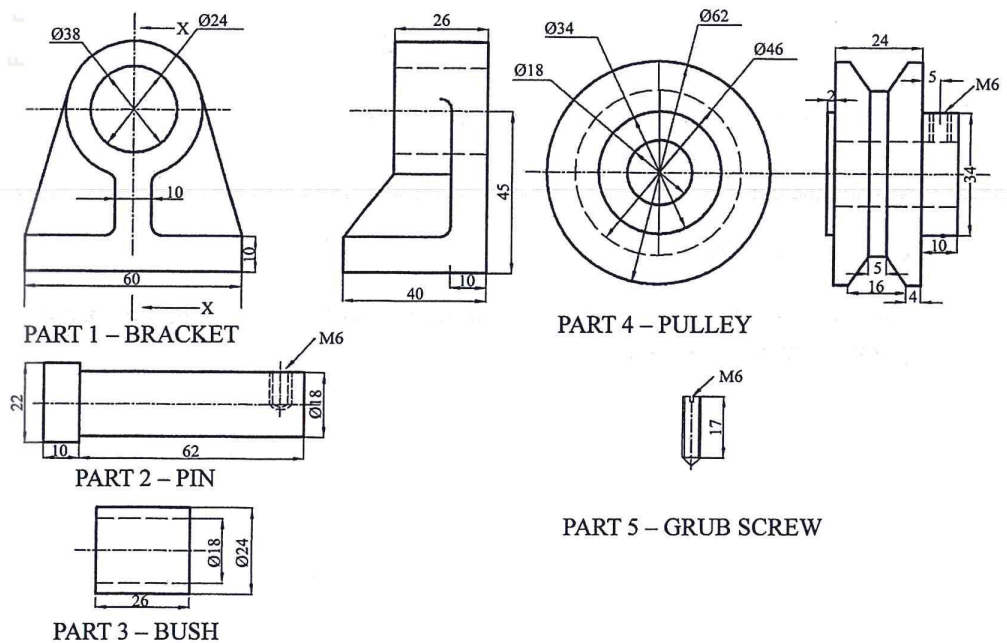
Figure 4

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

(20 marks)

(a)   Section X-X.

(b)   End elevation.

SECTION C (30 marks)

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

12.   **Figure 5** shows three orthographic view of a bracket drawn in first angle projection.
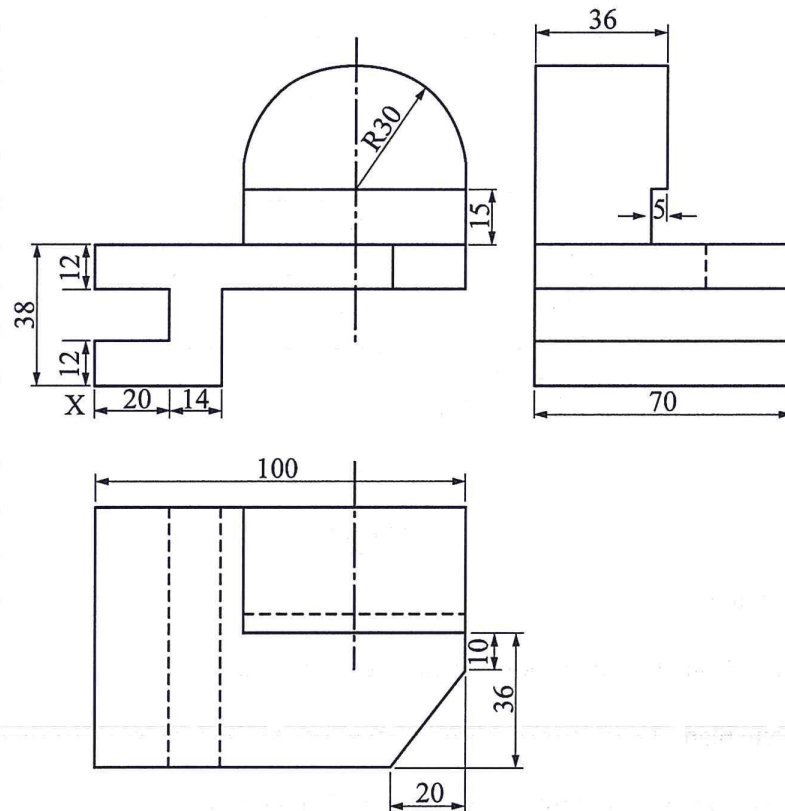
Figure 5

Draw the bracket in isometric projection taking X as the lowest point.   (15 marks)

13. **Figure 6** shows two square tubes **A** and **B** intersecting at an angle of 30°.
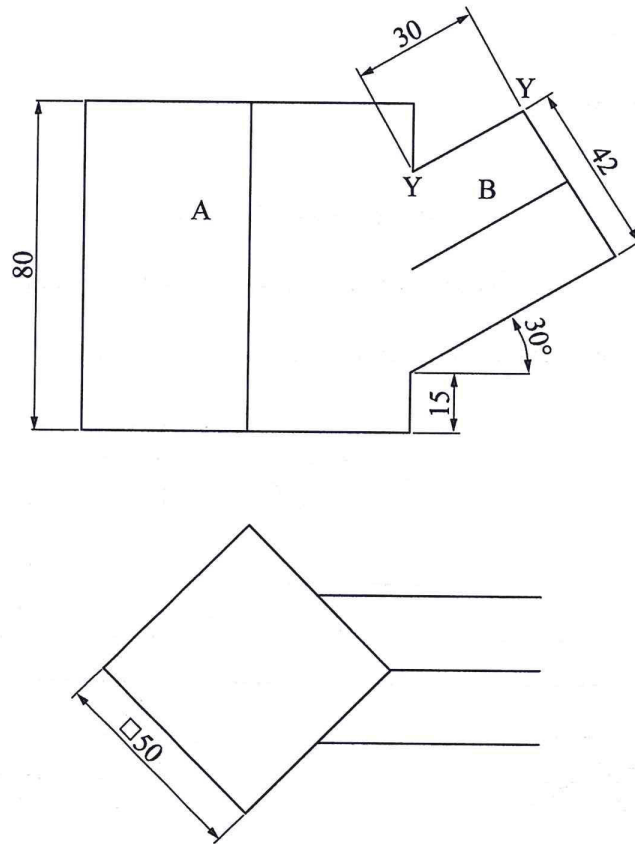
Figure 6

Draw the following: (15 marks)

(a)   Complete front elevation showing the line of intersection

(b)   Complete plan

(c)   Surface development of tube B when opened along Y-Y

14. **Figure 7** shows a wheel whose diameter is 60 mm, rotating along a flat surface without sliding.

DIRECTION OF ROTATION

FLAT SURFACE

Figure 7

Plot the path followed by point P on the wheel, through one complete revolution.   (15 marks)

3.21.2 Drawing and Design Paper 2 (449/2)

DESIGN PROBLEM (40 marks)

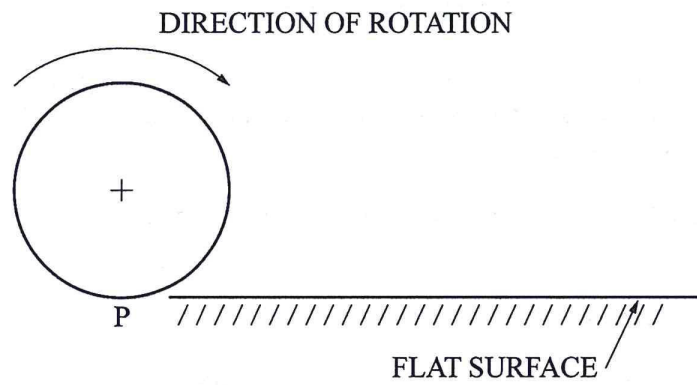Most carpenters face the challenge of fitting ceiling boards during construction or maintenance of buildings. Normally, two assistants are required to support the ceiling board when nailing. This creates congestion and is also expensive.

Design a stand that can be used to support the ceiling board when one person does the job, considering the following:

1. It should be easily moved around.

2. It should have provision for quick height adjustments.

3. It should have provision for fine height adjustments.

4. The top should be able to be swivelled horizontally.

5. The top should have provision for adjustment to accommodate different sizes of ceiling boards.

REQUIREMENTS

(a) Make free-hand pictorial sketches of two possible designs of the stand. (8 marks)

(b) Select **one** of the designs in (a) above and make a refined pictorial drawing. (14 marks)

(c) Make detailed exploded sketches of the mechanism used in considerations (2), (3) and (5) above. (13 marks)

(d) List **two** types of materials used in the stand. (1 mark)

(e) List **four** methods that could be used in joining the parts, and state where each is applied. (4 marks)

3.24 AVIATION TECHNOLOGY (450)

3.24.1 Aviation Technology Paper 1 (450/1)

SECTION A (44 marks)

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

1. Outline **three** roles of the 1st officer or co-pilot.

    (3 marks)

2. (a) Give the reasons why the following safety equipment must be carried on an aircraft.

    (i)   Raft

    (ii) Axe

    (2 marks)

    (b) Outline **two** safety precautions to observe when using each of the following tools:

    (i)   Hand files

    (ii) Taps

    (2 marks)

3. (a) List the type of clouds which:

    (i)   can project up into the stratosphere

    (ii) would cause moderate to severe aircraft icing

    (1 mark)

    (b) Distinguish between the compass swing and the engine test areas. (2 marks)

4. (a) Sketch the following types of locking devices.

    (i)   Spring washer   (ii) Shake proof washer

    (2 marks)

    (b) State **four** properties of aluminium alloy which makes it suitable for aircraft construction. (2 marks)

5. (a) Explain the meaning of each of the following terms as applied in aviation:

    (i)   Indicated airspeed

    (ii)   Mach number

    (iii) Viscosity

    (3 marks)

    (b) With the aid of sketches, describe each of the following wing configurations:

    (i)   Mid-wing

(ii)   Dihedral

(4 marks)

6.   (a)   Outline **three** functions of the aircraft bulkhead.   (3 marks)

      (b)   State the use of an inspection mirror in aircraft non-destructive testing.   (1 mark)

7.   (a)   Draw a cross-section of a cylinder piston assembly and show the following:

             (i)   Cylinder   (ii)   Piston
             (iii)   Connecting rod   (iv)   Stroke

(4 marks)

      (b)   Explain the application of Newton's third law of motion to a gas turbine engine.

(2 marks)

8.   (a)   Outline **three** methods of flight control systems.   (3 marks)

      (b)   Name the type of instrument used to indicate each of the following:

             (i)   Aircraft pitching up and down

             (ii)   The rate of altitude change

(1 mark)

9.   Outline the procedure of cutting internal threads.   (6 marks)

10.   Draw the symbol for each of the following as used in technical drawing.

      (a)   First angle projection

(1 mark)

      (b)   Switch socket outlet

(1 mark)

      (c)   External threads

(1 mark)

SECTION B (56 marks)

*Answer any **four** questions from this section in the spaces provided.*

11.   (a)   With the aid of a labelled sketch, show each of the following:

             (i)   Angle of attack
             (ii)   Anhedral
             (iii)   Angle of incidence

(6 marks)

      (b)   State **four** factors that determine aircraft drag.   (2 marks)

      (c)   With the aid of a labelled sketch, explain how the moments are balanced in flight.

(6 marks)

12. With the aid of a labelled sketch, show the construction and airflow on a high bypass gas turbine engine.

(14 marks)

13. Describe each of the following areas of the airport:

(a)   (i)   Threshold

     (ii)   Runway

(iii)   Touch down zone

(3 marks)

(b)   (i)   Outline **five** major causes of accidents in the aviation environment.

(ii)   Name **four** ways of communicating on the airside.

(7 marks)

(c)   Explain the following aircraft tasks:

(i)   Parking

(ii)   Picketing

(iii)   Jacking

(iv)   Trestling

(2 marks)

(b)   Draw and label a cross section of unbalanced double acting actuator.

(2 marks)

(c)   With the aid of a labelled cross-sectional sketch, describe an airspeed indicator.

(10 marks)

15. **Figure 1** shows an aircraft engine bracket drawn in isometric projection. In good proportion, draw in first angle projection the following views:

(a) Font elevation in the direction of arrow F.E.

(b) End elevation in the direction of arrow E.E.

(c) Plan
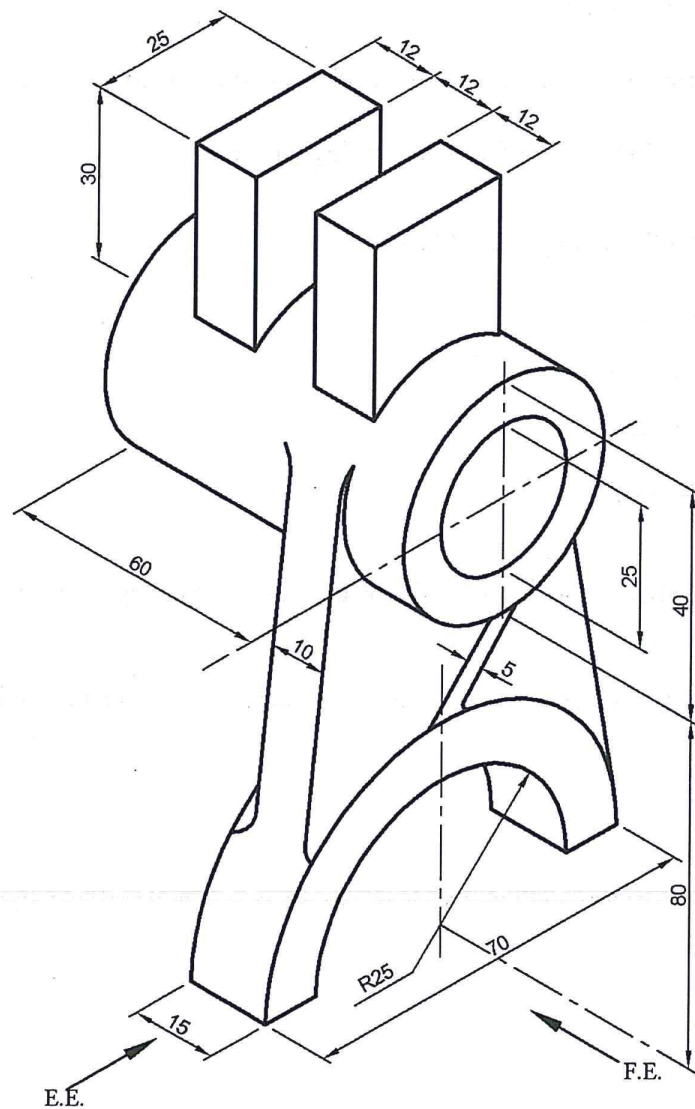
Figure 1

(14 marks)

STATION 1

INSTRUCTIONS

Figure 1 shows parts of a fan engine.

(a)   In the space provided, sketch in good proportion the assembled engine.   (7 marks)

(b)   Label **six** parts.   (3 marks)
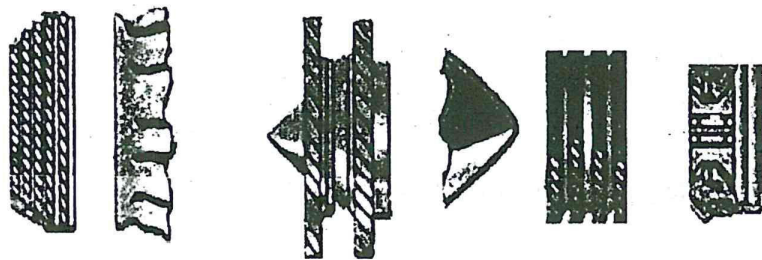
Figure 1

STATION 2

INSTRUCTIONS

Using the tools, equipment and materials provided, make the drive key as shown in **figure 2**.

(10 marks)
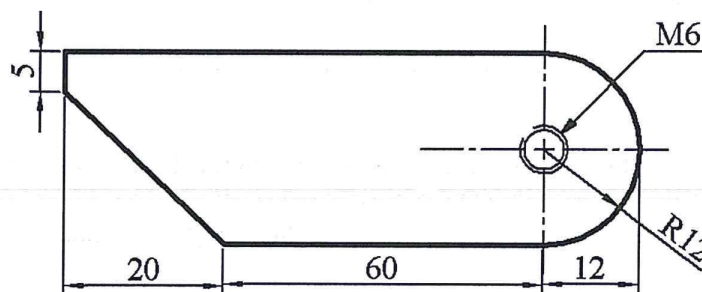
Figure 2

STATION 3

INSTRUCTIONS

Using the tools and components provided, carry out the following tasks:

(a) (i) Check and record the block top surface for warpage gap and condition.

Gap size ....

Condition ....

(ii) Name the tools used.

Tools ....

(iii) State **one** safety precaution to observe in (a)(i).

(3 marks)

(b) (i) Check and record the condition of the cylinder wall.

Condition ....

(ii) Give the recommendation based on the results in (b)(i) above.

Recommendations ....

(2 marks)

(c) (i) Measure and record the internal diameter of the bore at points **X**, **Y** and **Z**.

X .... **Y** .... **Z** ....

(3 marks)

(ii) From the size of diameters in (c)(i) above, determine the size of the bore and cylindricity.

Bore .... Cylindricity ....

(1 mark)

(iii) Basing on the results in (c)(i) and (c)(ii) above, give recommendations.   (1 mark)

STATION 4

INSTRUCTIONS

(a)   Identify and state the application of each of the parts of aircraft hydraulic system labelled 1–4. Complete the table provided.

Part	Identification	Application
1		
2		
3		
4		

(4 marks)

(b)   Measure and record the size of pipes labelled 5 and 6.

(i)   Size of pipe 5 ....   (ii) Size of paper 6 ....

(2 marks)

(c)   Identify **two** defects on each of the pipes in (b) above.

(i)   Defects on pipe 5 ....

(ii)   Defects on pipe 6 ....

(2 marks)

(d)   State **two** serviceability checks that must be carried out on item 6 before fitting on an aircraft.

(1 mark)

(e)   Identify the system where each of the pipes in (b) are used.

Pipe 5 ....

Pipe 6 ....

(1 mark)

STATION 5

INSTRUCTIONS

Using the materials and equipment provided, carry out the following tasks:

(a)   Switch on the air compressor and allow pressure to build up to about 10 bars. Open the air flow valve marked **R** slowly and hold the hose labelled **T** vertically so that the stream of gases are directed straight up. Let the examiner check the set up.   (1 mark)

(b)   (i)   Release the ping-pong ball marked **S** into the stream of air 30 centimetres from the nozzle. Record your observations.

           Observations ....

    (ii)   Slowly tip the nose so that air shoots out an angle. Record the observations.

           Observations ....

    (iii)   Repeat (b)(ii) with increased air pressure. Record the observation.

           Observations ....

    (iv)   State **three** reasons behind your observation in (b)(i) to (b)(iii).

           Reasons ....
                                                     (6 marks)

(c)   State:

    (i)   Where the principle is applicable in flight.

           Application ....

    (ii)   **Two** weather factors that can affect the observations in (b).

           Factors:

           (I)   ....
           (II)   ....
                                                     (3 marks)

STATION 6

INSTRUCTIONS

An aircraft is to be flown from point **E** to **P** eastwards. The wind speed at the altitude of the intended flight is 45 knots from the northeast, while the true airspeed of the aeroplane is 120 knots.

Using the drawing instruments and the plain paper provided, carry out the following tasks.

(a)   Construct in **four** steps a wind triangle for navigation purposes.   (8 marks)

(b)   Measure and record the true heading by direct measurement and wind correction angle.

    (i)   Direct measurement ....

    (ii)   Wind correction angle ....

                                                                                                          (2 marks)

STATION 7

INSTRUCTIONS

(a)   Drop the ball marked **Z** in the jar labelled 10.

    (i)   Record your observation

    Observation ....

    (ii)   State the reasons behind your observation

    Reasons ....

    (iii)   Explain the principle behind your observation

    Principle ....

    (iv)   State **two** areas where applicable in an aircraft.

    Applications ....

                                                                                                          (4 marks)

(b)   Using the materials provided, make each of the following aircraft wing plan forms:

    (i)   Elliptical

    (ii)   Delta

    (iii)   Sweepback

    (iv)   Rectangular

                                                                                                          (4 marks)