SUBJECT : ENGINEERING GRAPHICS / ENGINEERING DRAWING (JUNE

CODE : A-02(N)/A-02 TIME : 3 HOURS MAX MARKS 100

Note: this paper contains EIGHT questions, which are grouped in three sections A, B and C

(a) Section A contains TWO questions which are COMPULSORY
(b) Q.1 carries 20 marks, Q2 carries 35 marks and the remaining questions carry 15 marks each.
(c) Detach Answer Sheet for Q. No.1 from the question paper and answer Q.1 only on this sheet. Attach it to the main drawing sheet.
(d) Remaining questions are to be answered on the main drawing sheet.
(e) Retain all construction lines in the case of questions on plane and solid geometry.
(f) Follow Code of Engineering Drawing Practice IS 696.
(g) All dimensions are to be given in mm.
(h) Any missing dimension may be suitably assumed.

## SECTION –A COMPULSORY

1. This question has 10 parts. Each part carries 2 marks.

   a) Fig 1a gives two orthographic views of a plane in I-angle projection system. Draw the third view.
   b) Fig 1b gives two orthographic views of a solid. Draw the isometric view.
   c) Fig 1c shows pictorial view of a block. Draw the front and right side views using III angle projection system.
   d) Draw the sectional front view of the solid shown in question no 1(c).ie. Fig 1c.
   e) Sketch free hand a square Bolt and Nut.
   f) Draw a neat section of a Butt joint with two cover plates.
   g) Describe a cotter. What is it function?
   h) Define "Fillet" and 'faced parts'.
   i) What is the use of "Tolerance" in Machine Design?
   j) Sketch the cube in perspective.

2 Fig 2 shows pictorial view of a Bearing Bracket. Using I-angle projection system, draw the following:
   i) View in the direction of arrow A.
   ii) Sectional view at SP.
   Layout the views in accordance with IS: 696.Give important dimensions.

## SECTION B

Note : Attempt only two questions from this section .Do not erase construction lines.

3. Fig 3 shows the orthographic projections in I angle of a solid.

   i) Draw the isometric view.
   ii) Draw the isometric scale. (11,4)

4 A right regular hexagonal pyramid, side of base20 mm. and height 60 mm. so held on an auxiliary horizontal plane, such that one of its base edges in on the AHP , its vertex is towards the VP and 6 mm away from it and its axis parallel to the HP and inclined to V.P. at 30 degree.
Draw the top view and front view and right side view (15)

5 A right circular cylinder base diameter 45 mm and height 65 mm rests on its base in the H.P. A section plane perpendicular to V.P. and inclined to H.P. at 60 degree cuts the axis at a point 3 mm from its top end.
Draw front view, sectional top view and true shape of the truncated part. (15)

6. Develop the lateral surface of a right regular hexagonal prism of 20 mm base edge and 50 mm height (15)

## SECTION C

Note: Attempt anyone question from this section. Do not erase the construction lines.

7. Draw at least three complete turns of a single start V- thread in front view, given major diameter as 70 mm, pitch 16 mm and core diameter as 42 mm. (15)

8. Draw an ellipse by intersecting arcs method, given its major and minor axis as 100 mm and 70 mm respectively. (15)

QNO.2

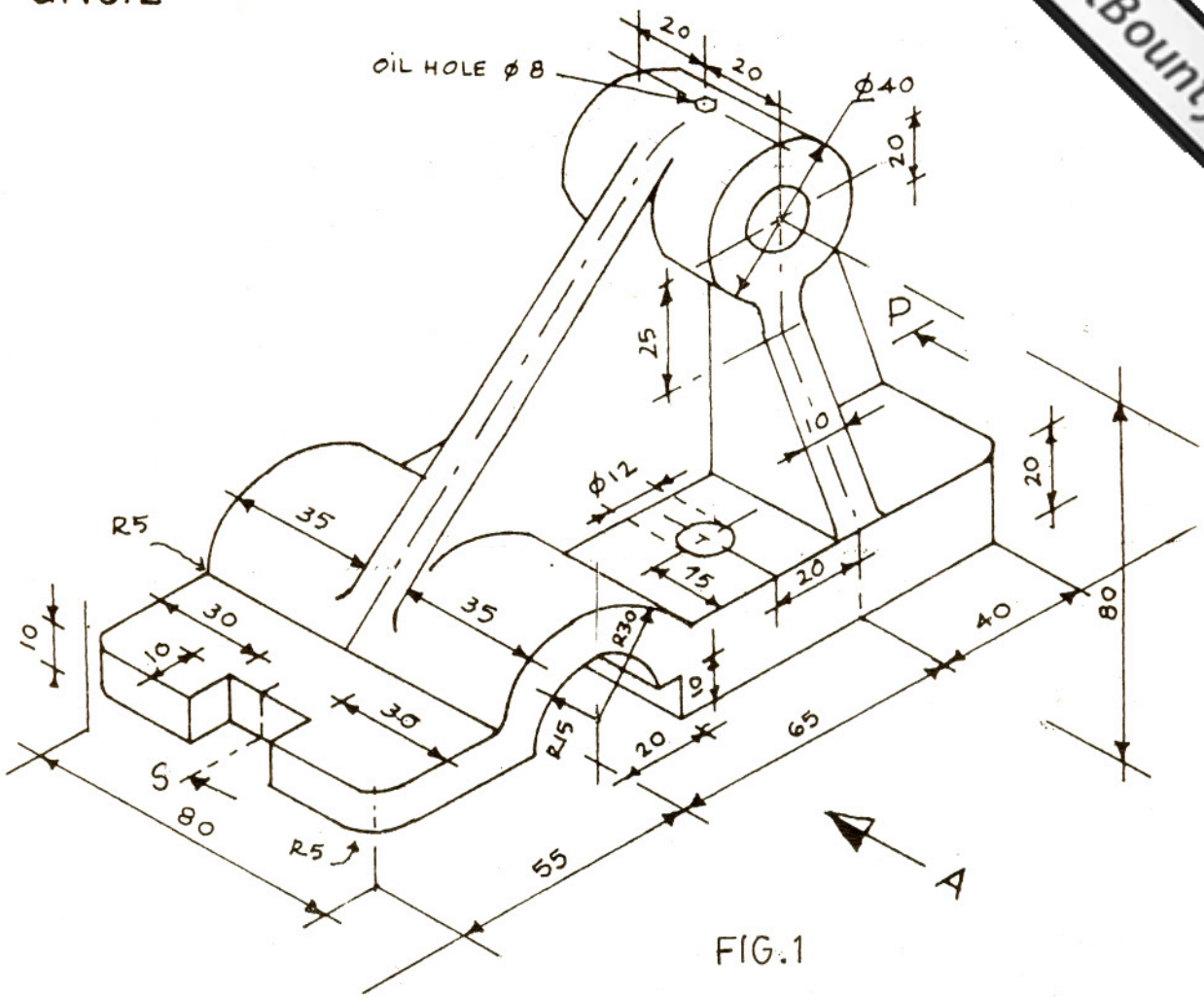



FIG.1

PICTORIAL VIEW OF BEARING BRACKET

QNO.3.

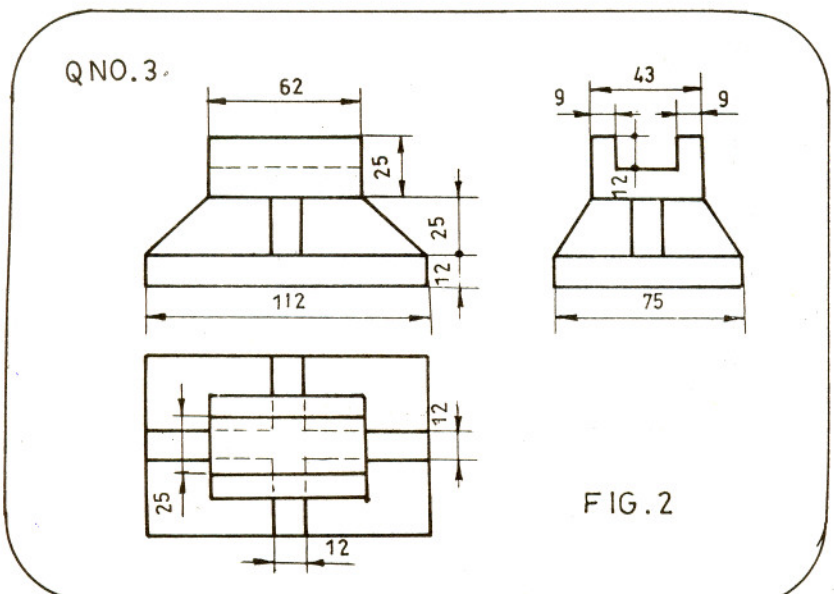
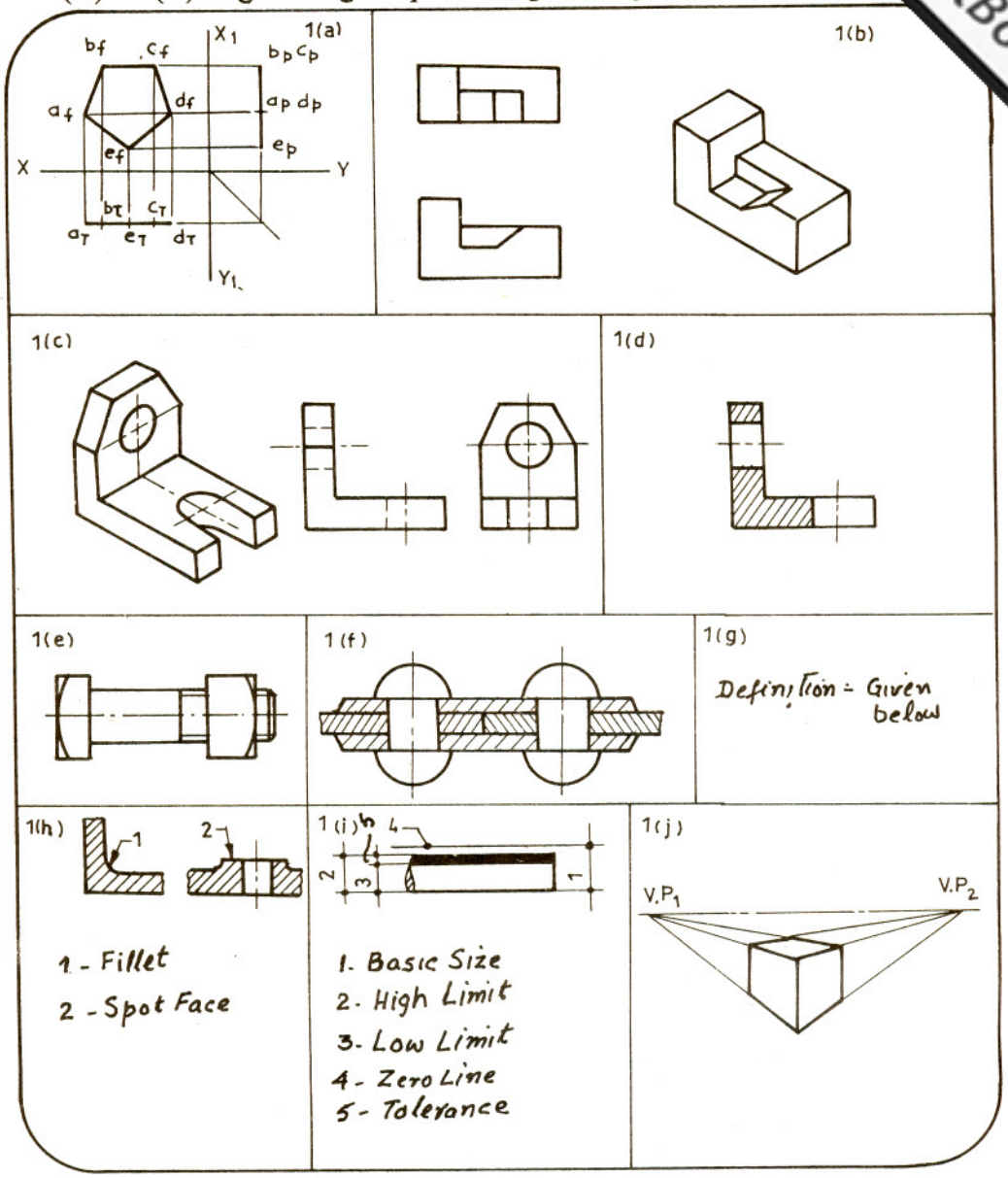



FIG.2




Q.1 (g)

Cotter

A cotter is a flat wedge shaped piece of steel of rectangular cross section, uniform in thickness but tapering in width.

Cotter is used to connect rigidly two rods subjected to tensile or compressive forces and is inserted at right angles to the axes of the rods.

Q.1 (h)

Fillet

This is the term given to the arc on internal corners often found in castings to avoid sharp corners (See fig. 1h).

Faced parts

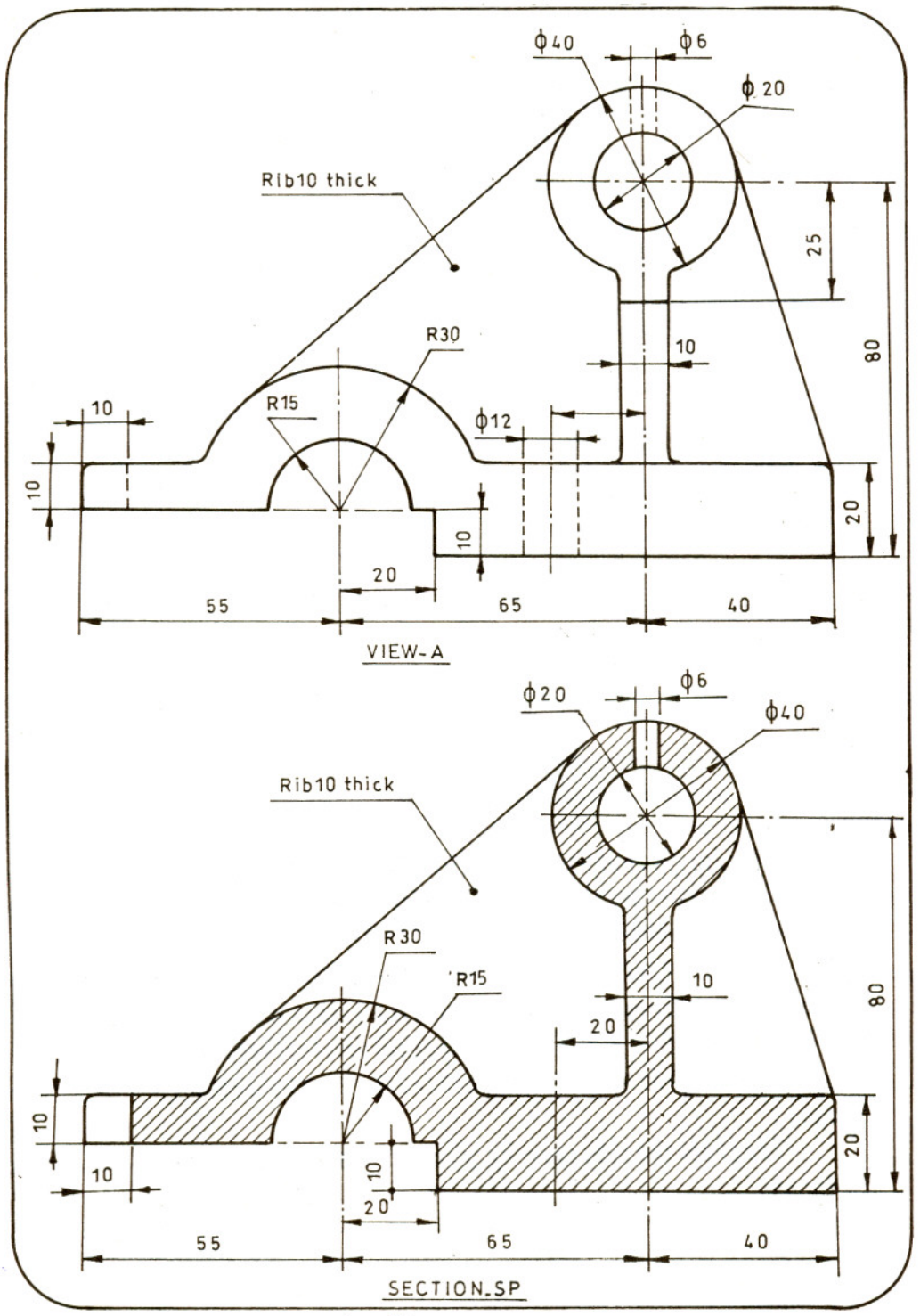
Faced parts are those surfaces, which are finished around holes to provide bearing surfaces for washers or nuts. In fact it is the raised cylindrical element

Q1 (i)

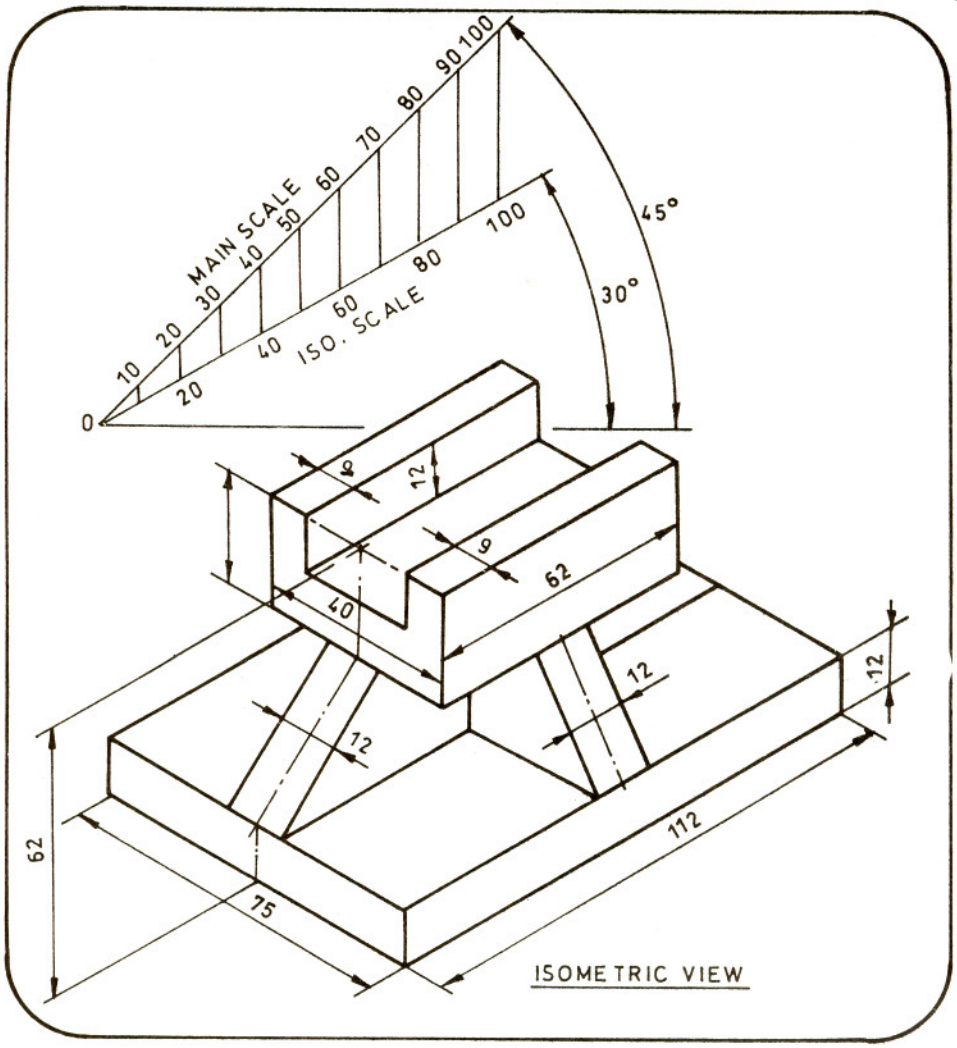
Tolerance in machine design

Even with the best machines and workmanship it is impossible to obt certain dimension of a part precisely, but in order to meet its purpose, it is sufficient that it should be made as to lie within two permissible limits of size, the difference of which is the tolerance.

Tolerances are assigned by the designer to meet the functional requirements of the designed elements (see fig. 1(i))




Ans Q2



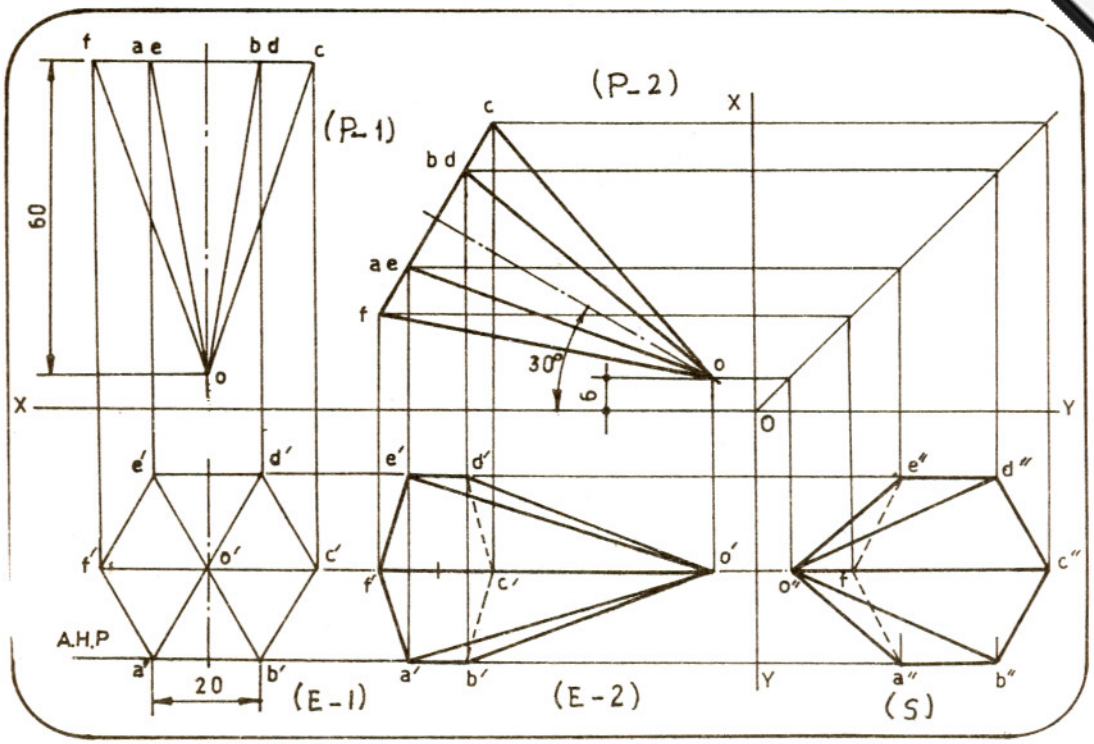

Q3

Q.4

This problem is given in III angle projection. Initially assume the solid is resting on A.H.P on one of its base edges and axis perpendicular to V.P. Draw its two sides, showing in elevation (E-1) and plan (P-1)

Reproduce $(P-1)$ to plan $(P-2)$ so that axis makes $45^0$ with $xy$ and apex 6mm away from it .In this position the axis of solid is inclined at $30^0$ to V.P and parallel to H.P. Obtain elevation $(E-2)$ by drawing vertical projectors from plan $(P-2)$ and horizontals from elevation $(E-1)$, as shown in figure.

Complete the side view by plan $(P-2)$ and elevation $(E-2)$ as shown in the figure.




Q4

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Q.5

The cylinder is resting on its base in the H.P. Draw its two views in this position. Show the cutting plane V.T at $60^0$ to $xy$ and passing through a point on the axis at a distance of 3mm from the top end.

Select number of point's $a^1$, $b^1$, $c^1$ etc. on V.T and common to the cylindrical portion. In the top view these points lie on the circle and hence the same circle is the top view of the section. The width of the section at any point, say c, will be equal to the length of the chord $c-c$ in the top view.

The true shape of section may be drawn by rotating the cut surface along $x_1y_1$ and then projecting vertically. The width of section can be projected horizontally from top view, say c' is revolved to $c_1'$, and projected vertically and $c-c$ is projected horizontally to locate $c_1-c_1$.

Complete the view as shown in figure.

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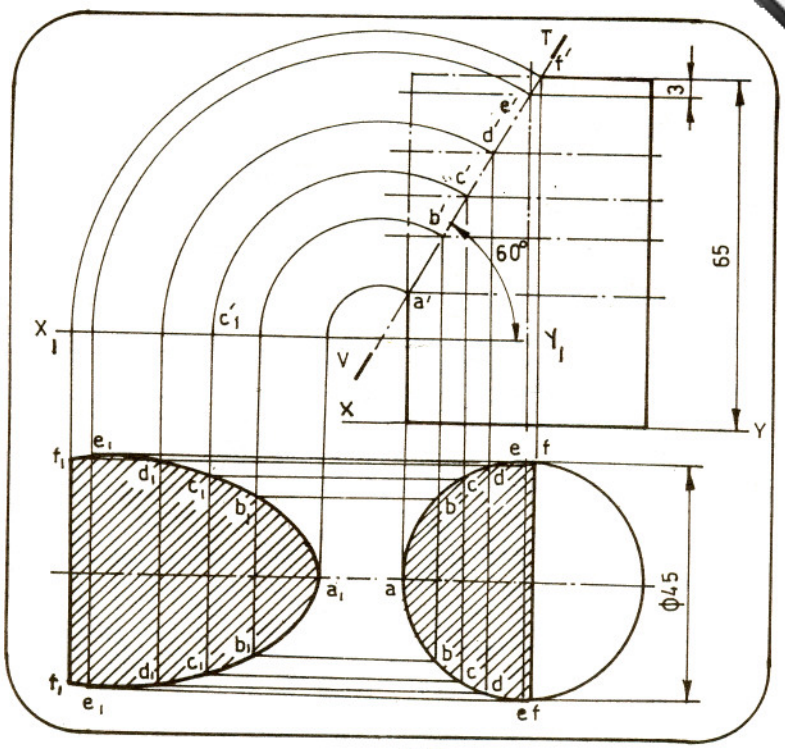
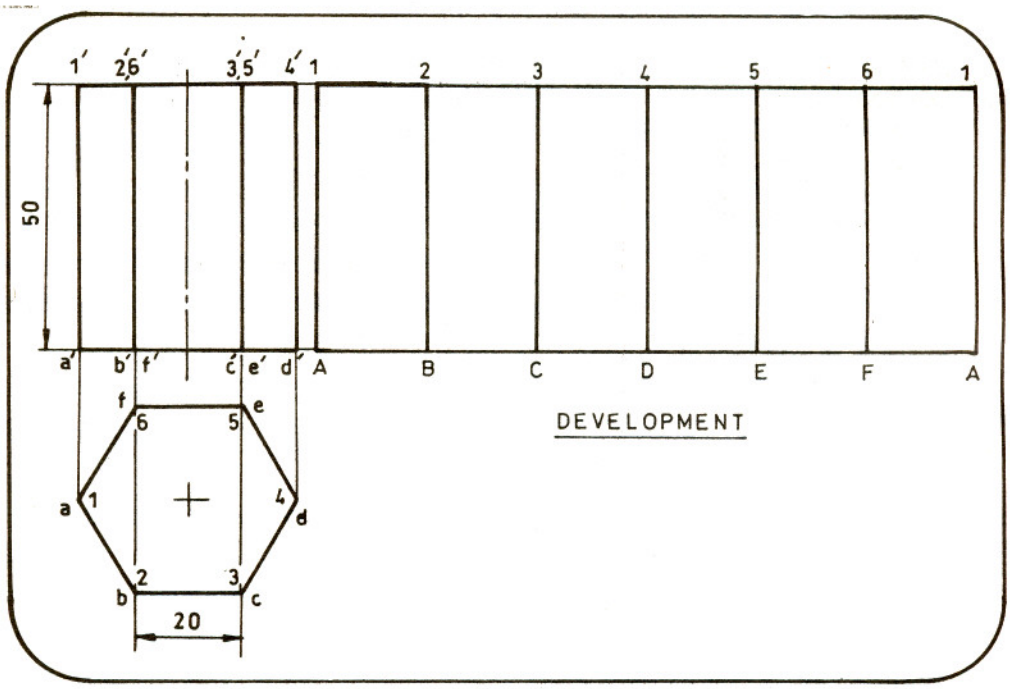



Q5

Q.6

Assume the prism to be resting on its base in the H.P. Draw its two views. Name all the corners of the prism, Draw the stretch out line $A-A$ and $1-1$ directly in the line of front view. Develop the prism as a whole. It is made of 6 rectangles. Step off $AB-BC-CD$ etc along $A-A$ in the development equal to 20mm each edge of the prism. Then complete the development as shown in figure.



Q.7

Draw two circles of diameter d=70mm and $d_1 = 42mm$ in the top view sho major and core diameters. Divide the circles into 12 equal parts. The radiating lines will cut the major circle in points 1,2,3 etc. and core circle in $1_1,2_1,3_1$ etc. Consider the height of the cylinder equals thrice the pitch $= 16 \times 3 = 48mm$. Project points 1,2,3 and $1^1,2^1,3^1$ etc. in the front view.

Take the pitch $S = 16$ and divide the pitch height also into 12 equal parts. Take the points of intersection of points 1,2,3 and $1_1,2_1,3_1$ etc. on the horizontal lines of pitch distance starting at B to draw the thread profile of V-Thread

Similarly draw other two pitches to complete the three turns of a single start V-Threads. (Section at AA is also shown)

Q.8

Draw a line AB equal to the major axis and the line CD equal to the minor axis, bisecting each other at right angles at O.

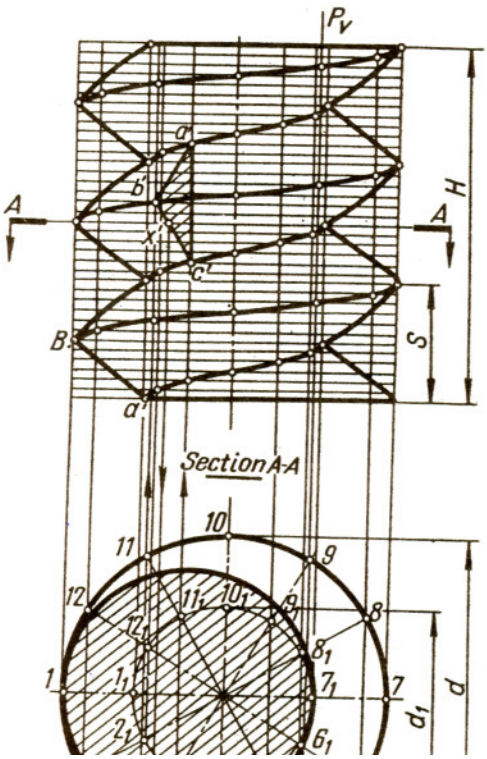
With center C and radius equal to half AB (i.e. AO) draw arcs cutting AB at $F_1$ and $F_2$, the foci of the ellipse.

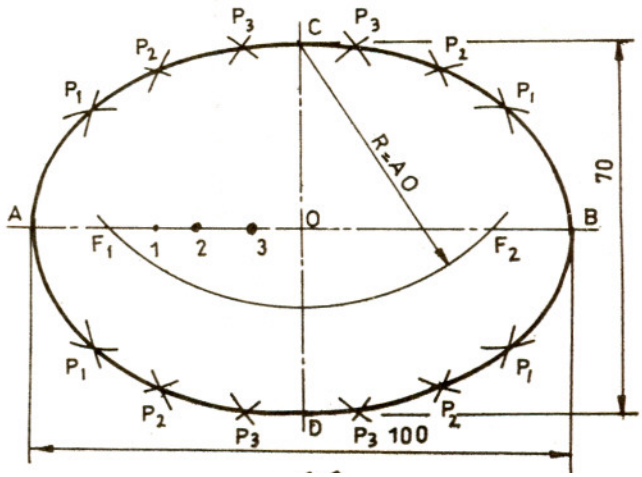
Mark a number of points 1,2,3 etc. on AB. With centers $F_1$ and $F_2$, and radius equal to A1, draw arcs on both sides of AB.

With same centers and radius equal to the B1, Draw arcs intersecting the previous arcs at four points marked $P_1$.

Similarly with radii $A_1$ and $B_2$, $A_3$ and $B_3$,etc. obtain more points $P_2,P_3$, etc.

Draw a smooth curve passing through these points. This curve is the required ellipse



SUBJECT: ENGINEERING GRAPHICS / ENGINEERING DRAWING

A-02(O)-A-02(N) TIME : 3 HOURS MAX MARKS 100

NOTE : The paper contains eight questions. These are grouped in three sections, viz A, B, C.

1) Section A contains two questions. Both are compulsory.
2) Question no. 1 is to be answered on this sheet itself. Attach this sheet to the drawing sheet on the left hand corner on the top fold. Write your roll no.on this sheet.
3) All other questions are to be attempted on the drawing sheet.
4) Retain all construction lines in questions relating to solid geometry and others. lines should be sharp & easily visible. Five marks are for neat and accurate drg.
5) Do not smudge your drawings. Draw neatly and accurately. Label and give dimensions wherever necessary.
6) All dimensions are in mm. any missing dimension/information may be assumed and stated accordingly.

IMP ; SPACE FOR THE SOLUTION TO QUESTIONS NO 1

Mark X on the circle A or B to indicate your answer to the question

| Q. No | | | | | |
|---|---|---|---|---|---|
| | (a) A B | (b) A B | (c) A B | (d) A B | (e) A B |
| | (f) A B | (g) A B | (h) A B | (i) A B | (j) A B |

## SECTION A (COMPULSARY)

1) It has ten parts. Each part carries two marks. The questions are objective type. You are required to mark X on the circle indicating the correct answer.

Q1 Choose the correct or the best alternative in the following 2×10

a) A) RF = $\frac{1cm}{0.5\times100cm}$ A

B) RF = $\frac{1cm}{0.5\times1metre}$

b) When a line is parallel to one of the coordinate planes and inclined to the other two planes.
   A) The projection of the line on the plane parallel to it gives true length A
   B) The projection of the line on the inclined planes gives its true length.

c) When a curved surface is tangent to a plane surface

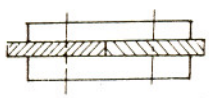
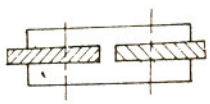
A) In orthographic projections no line should be drawn
B) In orthographic projection a short dashed line should be drawn

d) In a perspective drawing objects having same true dimension

A) Are shown in unequal measure
B) Are shown only in equal measure.

A

e) Which is correct representation of a Butt joint joining two metal sheets.

(A)  (B) 

A

f) In accepted conventional drawing hidden parts and edges are indicated as

A

(A) - - - - - - - - - - - - - - -
(B) ——— · ——— · ———

g) An oblique surface is

A) Oblique to more than one principal plane
B) Oblique to all three principal planes

B

h) Square threads result from a schematic combination of

A) Three helices
B) Four helices

B

i) Vernier scales are useful for measuring

A) Very small dimensional units
B) A large number of varying sized units

A

j) Lateral surface development for pattern making

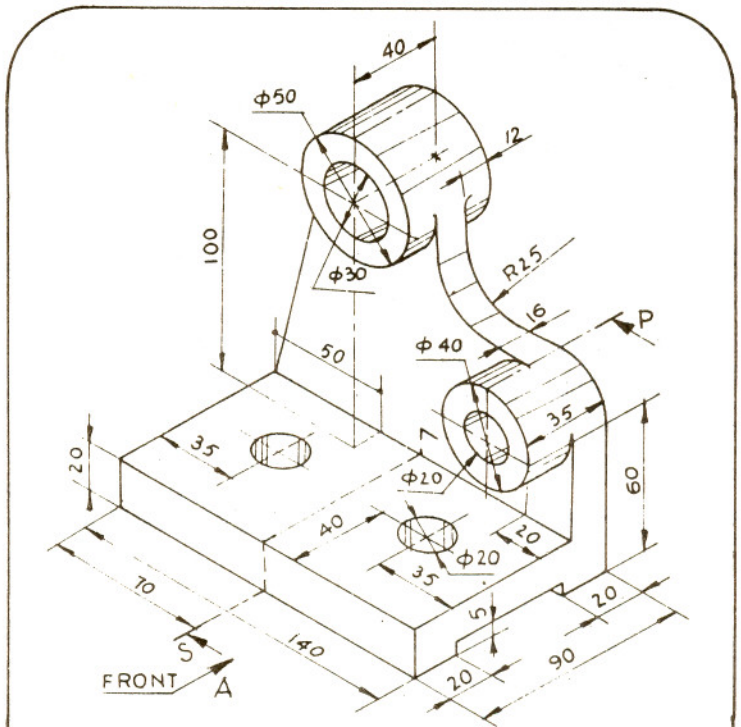
A) Does not include the end faces
B) Includes the end faces

A

Q 2 figure 1 shows the pictorial view of a machine part draw the following
a) Top view
b) View in the direction of arrow A

c) Sectional view at Sp
Layout the views accurately and neatly in accordance with I[illegible] and indicate the important dimensions.

Q NO 2

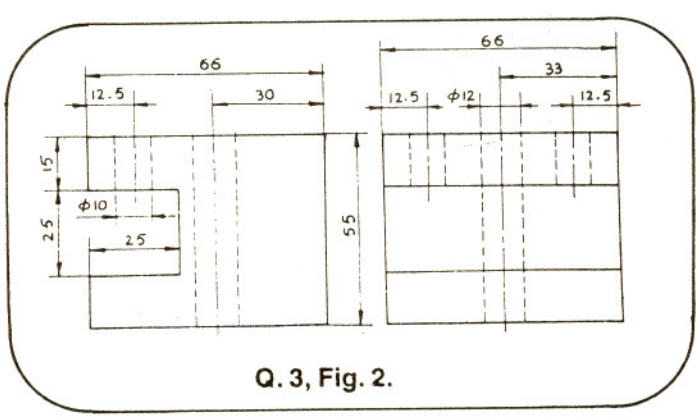



Q. 2, Fig. 1. Machine Part

## SECTION B

Note : Attempt any two questions from this section. Do not erase the construction lines.

Q3 Figure 2 shows the orthographic projections of a solid 10+5
i) Draw to scale an isometric view
ii) Draw the isometric scale used.




Q. 3, Fig. 2.

Q4 A truncated right cylinder tube has 40 mm dia base and is 60 mm high and [illegible] by a section plane At $45^0$ angle to the horizontal plane ( upper part is truncated) develop its lateral inside pattern. The thickness of the metal can be ignored. Do not erase construction lines. 15

Q5 A right regular square pyramid, base side 30 mm and axis 54mm long, rests, on H.P. on one of its base corners , in a manner so that the slant edge of the solid containing that corner is perpendicular to the H.P.

Draw the orthographic projection of the solid. 15

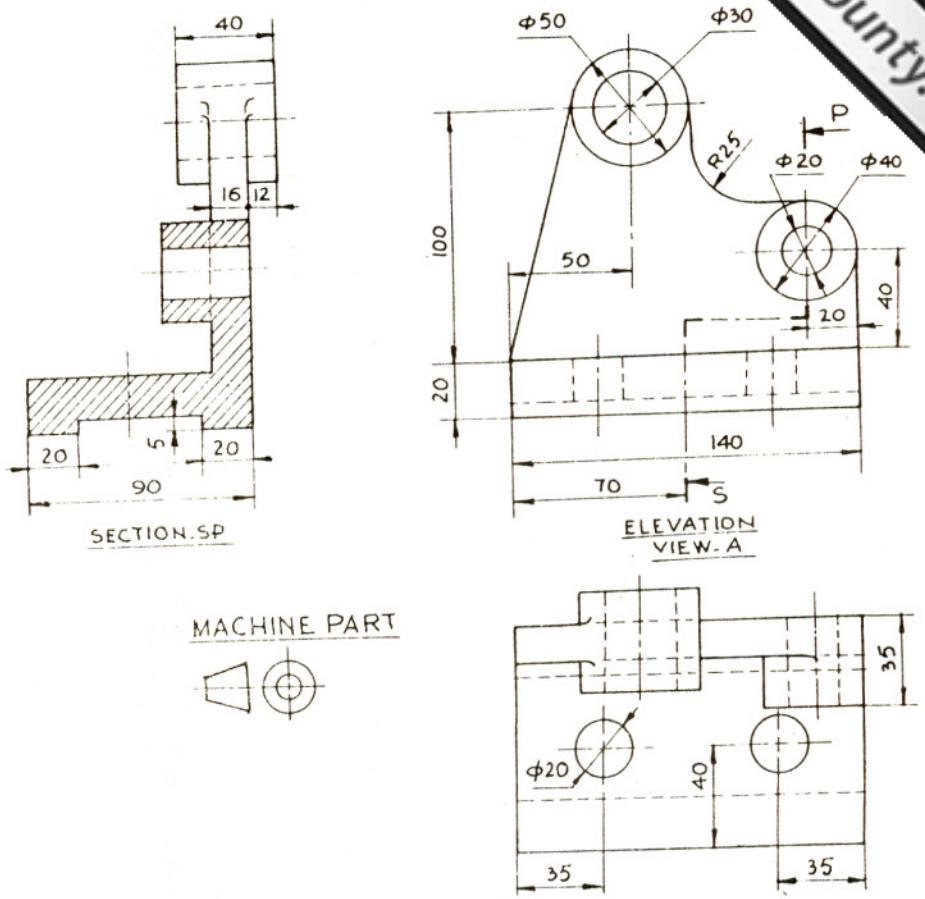
Q6 A cone having a 50 mm dia. base and 60 mm long axis is resting on its base on H.P. It is cut by a section plane which is perpendicular to both the reference plane in such a way that the true section is a hyperbole of 40 mm dia base. Draw the front view, top view, and the sectional view. 15

## SECTION C

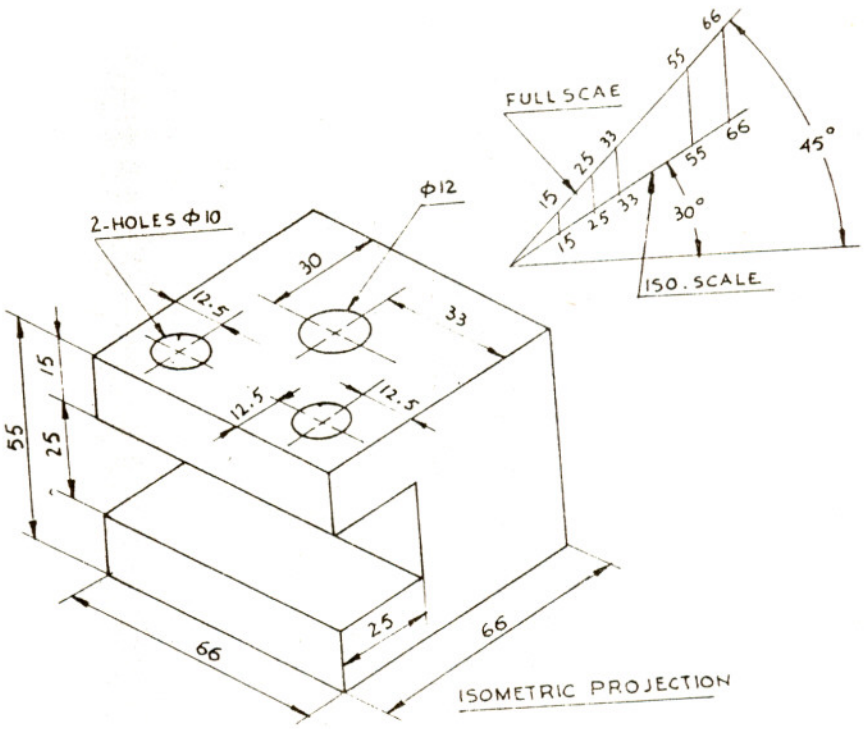
Attempt any one question

Q7 A parabola is having 105mm base and 75 mm axis. Draw the parabola using the offset method. Do not erase construction lines. 15

Q8 Given the core diameter as 50mm, major diameter as 70 mm and pitch as 18mm, draw a front view of a single start V- thread. Show a minimum of three complete turns of the thread. 15




Ans. Q. 2, Fig. 1.



Q.4

Draw the projection of the tube, assuming it to be resting on a circular fa
H.P. Divide the circle in the top view into twelve equal parts.
Project the division points in the front view and draw the generators. The leng
of the line 1-1 is equal to $\pi \times d$ (circumference of circle). This length can also be
marked approximately by stepping off with a bow divider, 12 divisions each equal to the chord length *ab*.
Assume the section of tube in the middle of axis and at $45^0$ to *xy*, shown by V.T in the figure. Mark points $a', b' \text{ and } b_1'$, $c'$ and $c_1'$ etc. in which the generators are cut.
Through these points draw horizontal lines to cut the corresponding generators in points $A, B \text{ and } B_1$ etc. Draw smooth curve through the points, thus obtained $1-A-A_1-1$ is the required development.

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Q.5

In the initial position assume the axis to be perpendicular to the H.P. Draw the projections with the base in *xy* and its base edge equally inclined to the V.P, as shown in elevations $(E-1)$ and plan $(P-1)$.
If the pyramid is now tilted about the corner A the axis will become inclined to H.P., but will remain parallel to the V.P.The distances of all the corners from V.P will remain constant.
Reproduce the elevation $(E-1)$ to elevation $(E-2)$ so that slant edge $o'a'$ (TL) is perpendicular to *xy* and $a^1$ remains in *xy*.
Project all the points vertically from the elevation $(E-1)$ and horizontally from the plan $(P-1)$. Complete the new plan $(P-2)$, by joining the points as shown in the figure.

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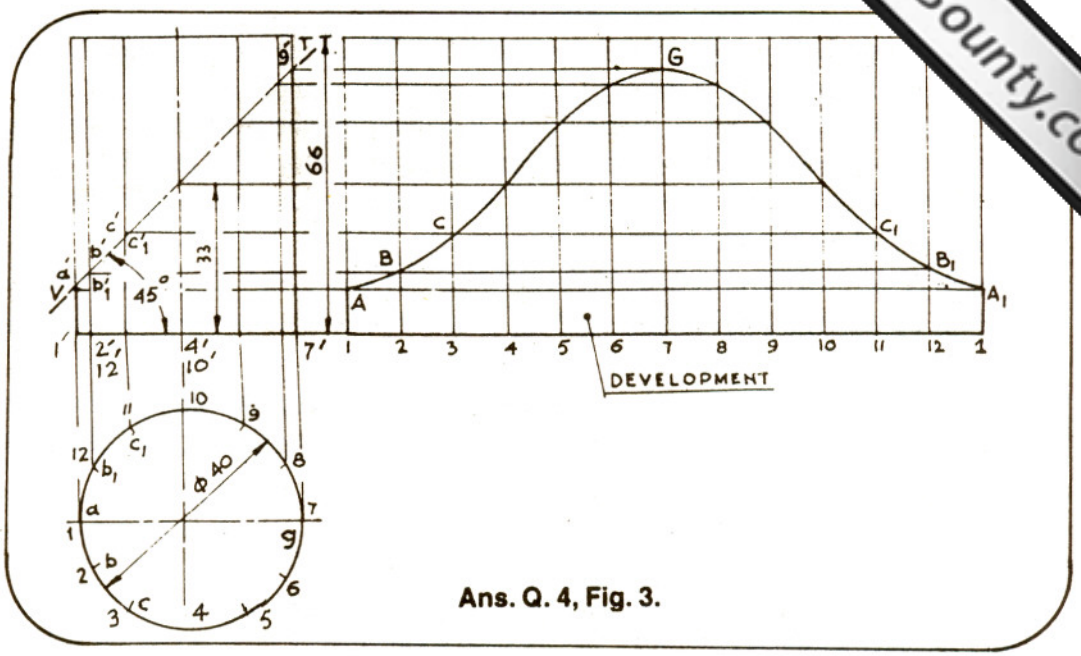
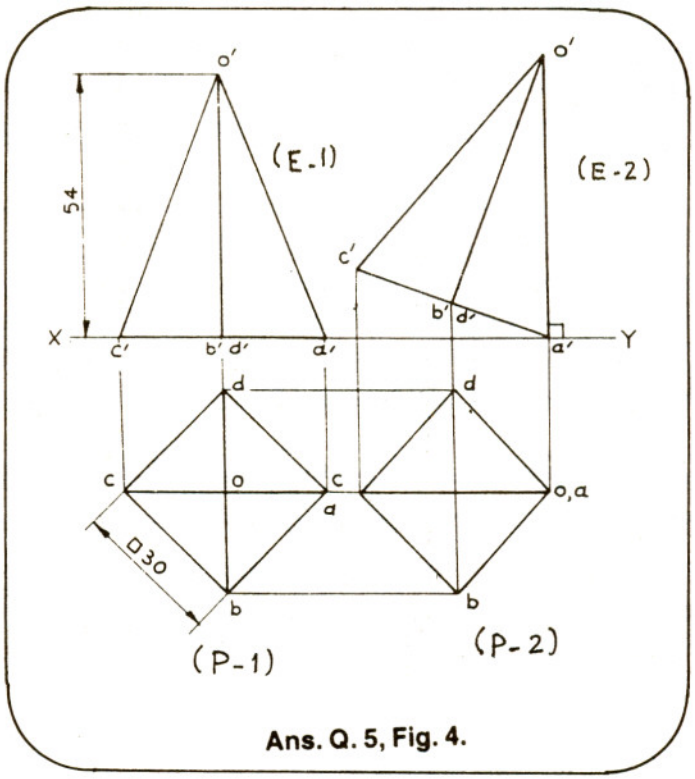
Q.6

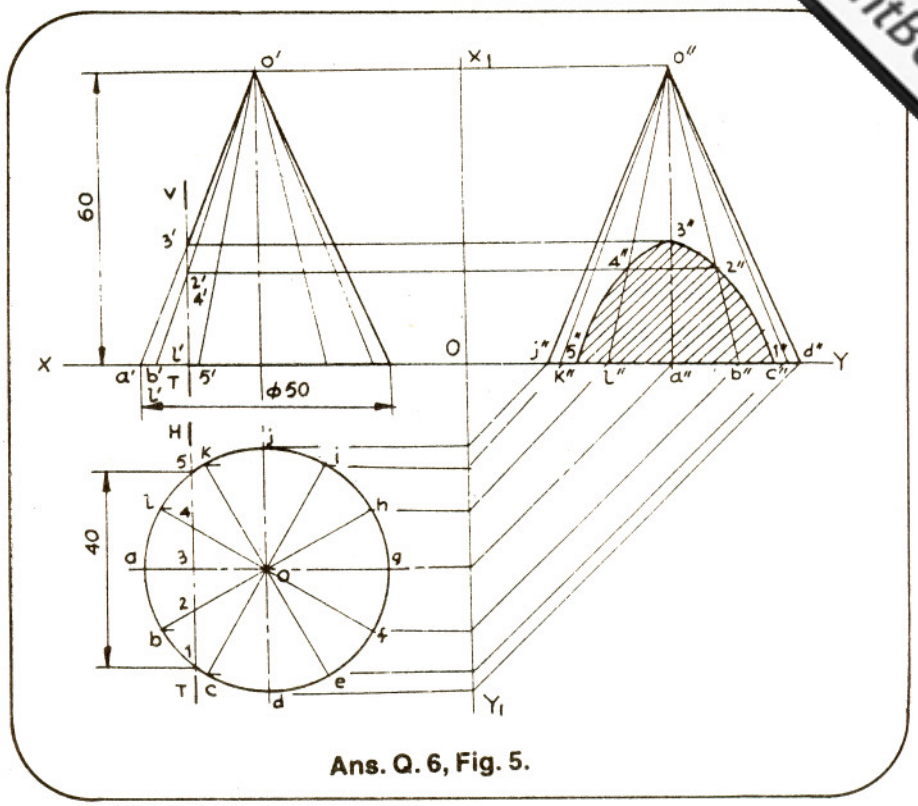
Draw the projections of the cone, assuming it to be resting on its base in the H.P. The section will be seen as a line, perpendicular to *xy*, in both the front view and top view. The side view will show the true shape of the section .The width of the section at any point, say $2',4'$ will be equal to 2,4 obtained on the generator ob and ol.
Draw the side view of the cone. Project the points (on the section) in the side view taking the widths from the top view. For example, through $2',4'$ draw a horizontal line. Mark on it points $2'',4''$ equidistant from and on both sides of the axis.
Draw the curve through the points thus obtained. In the solution the views are obtained by generator method.



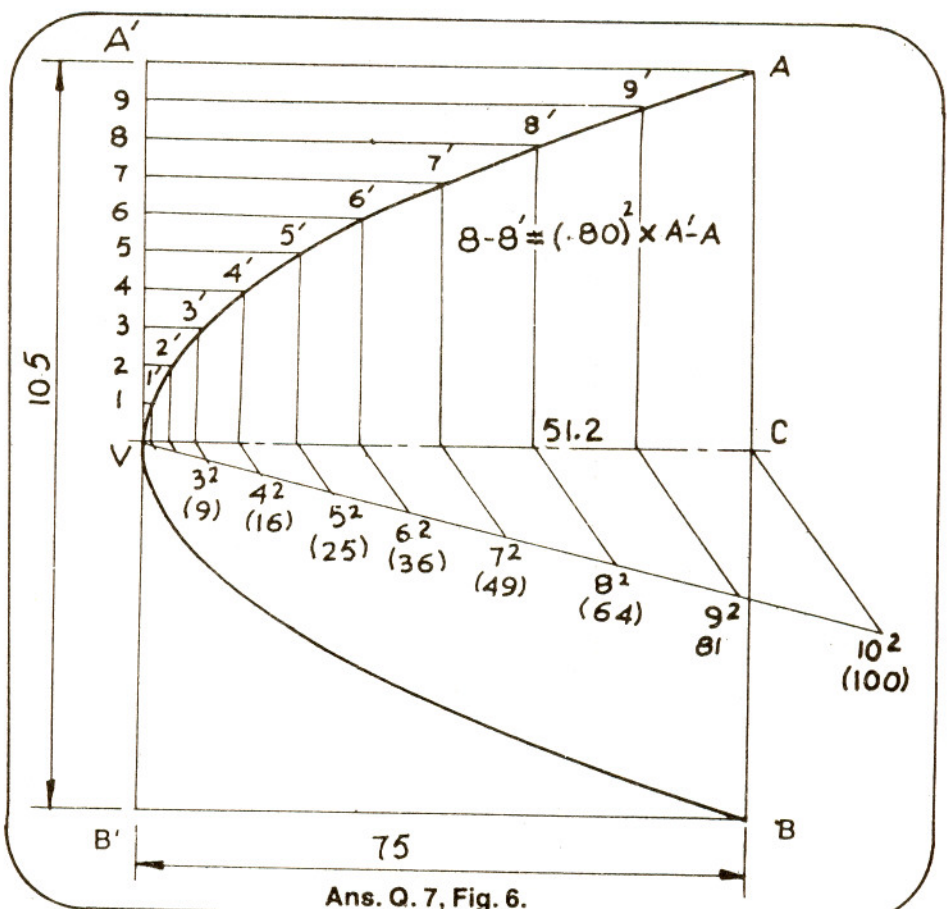

Ans. Q. 4, Fig. 3.




Ans. Q. 5, Fig. 4.




Ans. Q. 6, Fig. 5.




Ans. Q. 7, Fig. 6.

Q.7

Given the enclosing rectangle $A'ABB'$. Divide the $VA'$ into any nu al parts (say 10) and draw lines from the division points, parallel to axis which offset distances are to be laid off.

The offset vary as the square of their distances from V. For example, since $2-2'$ is two tenths of the distances from V to A'. $2-2'$ will be $(0.2)^2$ or 0.04 of AA Similarly $6-6'$ will be $(0.6)^2$ or 0.36 of AA and $8-8'$ will be 0.64 of A'A.

To complete the parabola, layoff the computed offset values along the perpendicular and then join the points with French curve.

The entire construction can be done graphically (as illustrated) by first calculating the values of the squared distances and then dividing the depth distance V.C proportionally using these values.

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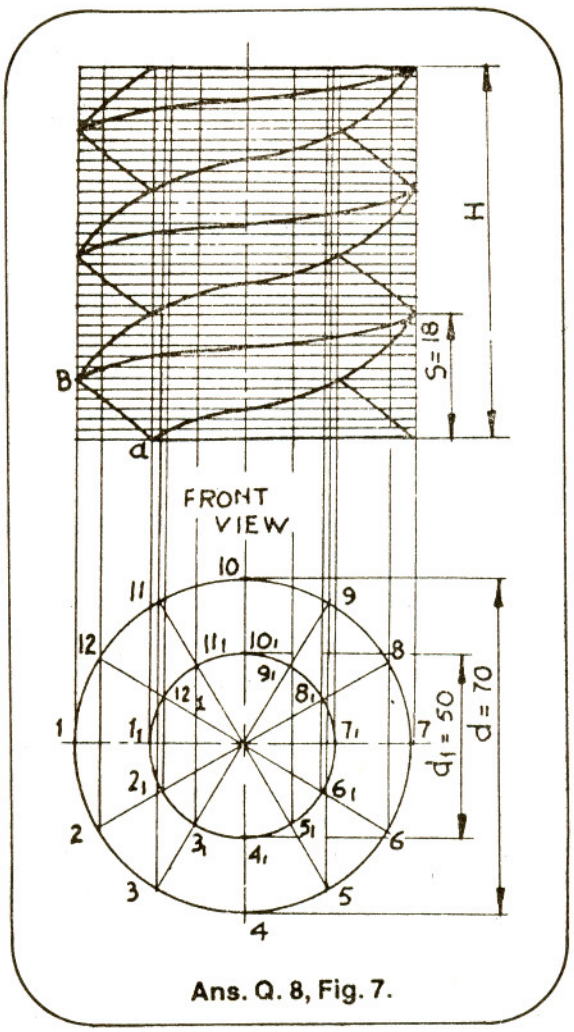
Q.8

Draw two circles d = 70 mm and 50 mm in the top view showing major and core diameters respectively. Divide the circles into 12 equal parts. The radiating lines will cut the major circles on points 1,2,3, etc. Consider the height of the cylinder H equal to thrice the pitch = 18 × 3 = 54 mm, project points 1,2,3 and $1_1,2_1,3_1$, etc in the front view.

Divide the pitch height into 12 equal parts, take the points of intersection of points 1, 2, 3, and $1_1$, $2_1$, $3_1$, etc on the horizontal lines of pitch distance starting at B to form the thread profile of V- threads, similarly other two pitches are drawn to complete the thread profile.




Ans. Q. 8, Fig. 7.

SUBJECT: ENGINEERING GRAPHICS / ENGINEERING DRAWING (20)

CODE NO: A-02(O)/A-02(N)/C-02 TIME 3 HOURS MAX MARKS

NOTE:

i) The question paper has 8 questions in all. These are grouped in three sections ie. ,A, B & C.

ii) Section A is compulsory & it contains two questions. Question 1 of this section is to be answered on the sheet specially provided for it. Detach the sheet from the question paper and attach the same on the left hand corner on the top fold of the drawing sheet.

iii) All other questions of section A, B & C are to be answered on the drawing sheet.

iv) Retain all construction lines and draw accurately and neatly. All lines should be sharp and clearly visible. Construction lines, normal lines and section lines should be of distinct thickness/intensity.

v) All the dimensions are in mm. any missing dimension/information maybe suitably assumed if necessary and stated.

Section A (compulsory)

The section has two questions. Both the questions are compulsory. Q. No. 1 is to be answered on the answer sheet attached to the question paper only.

Q.1 Draw or sketch neatly and to scale wherever required: 2×8

(a) Axis line Hidden line, Dimension line and Boundary line.

(b) Surface development of a cylinder of 20 mm dia. Base and 60 mm height, standing on its base.

(c) Interior of a room 15m×10m using single point parallel perspective.

(d) Letter 'S' in normal proportions, full scale, height being 56 mm.

(e) Figs (i) to (iv) show different Rivet joints. Name each type.

(f) Diagrams i) and ii) both show a cube. Identify the term used for each diagram. Also sketch the same cube in a perspective.

(g) Figs (i) to (iv) show parts in jointing bars. Name each part. Write deg in case of part shown in fig (ii).

(h) What do you understand by the term scale? What is a reducing scale? What is representative fraction?

Q2 For machine part shown in fig 1 , draw in first angle , the following orthographic projections :

42

a) Top view
b) Front view
c) Left side view

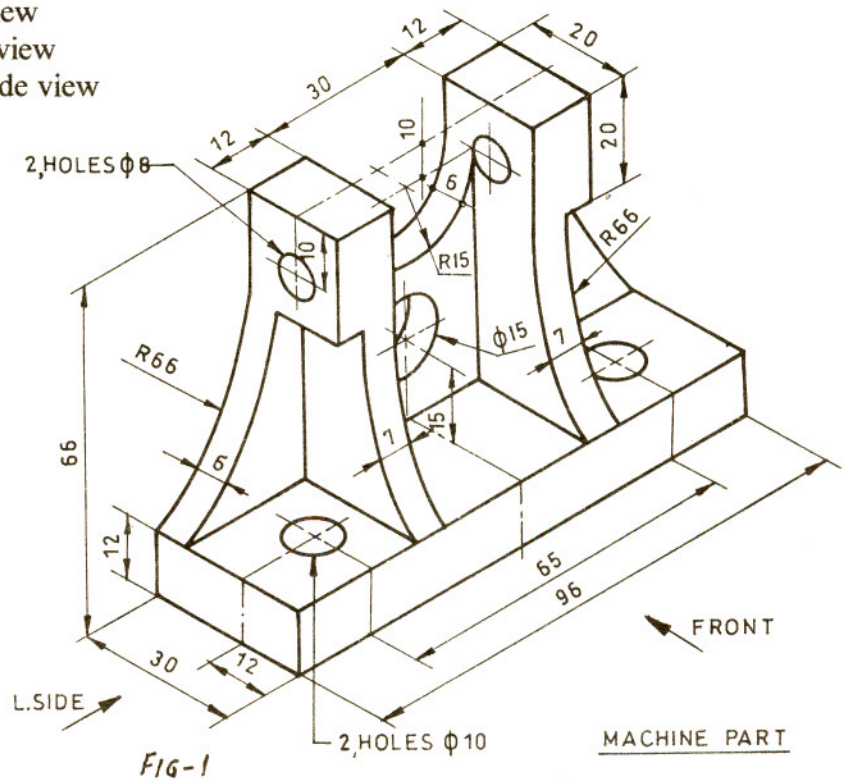



FIG-1

Section B: Answer any two questions from this section.

Q 3 Fig 2 shows the isometric view of a solid. Draw to a suitable scale in I angle / III angle the following orthographic projections :-

(a) Top view
(b) Front view
(c) Right hand side view

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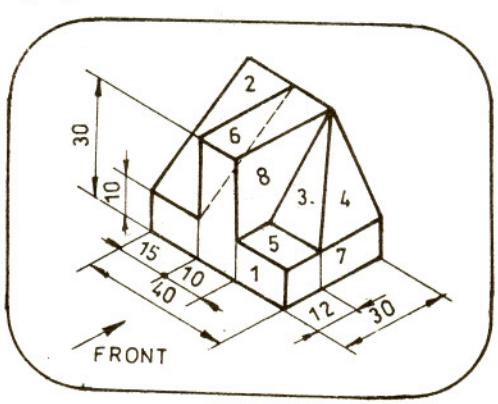



FIG. 2

Q 4 A right regular hexagonal prism, base edge 25 mm, and height [illegible] a 20 mm ϕ hole through and through along its axis.
Draw its projections when it is held on one of its base corners on H[illegible] its axis is parallel to VP and inclined at $30^0$ to HP.

Q 5 A pentagonal pyramid , side of the base 25 mm, and height 50 mm , rests on [illegible] on HP with one of its base edges perpendicular to VP. An auxiliary inclined pla[illegible] (AIP), incline to HP at $45^0$ cuts the pyramid bisecting its axis. Draw: - 14

(a) Front view
(b) Sectional top view
(c) True shape of the cut surface.

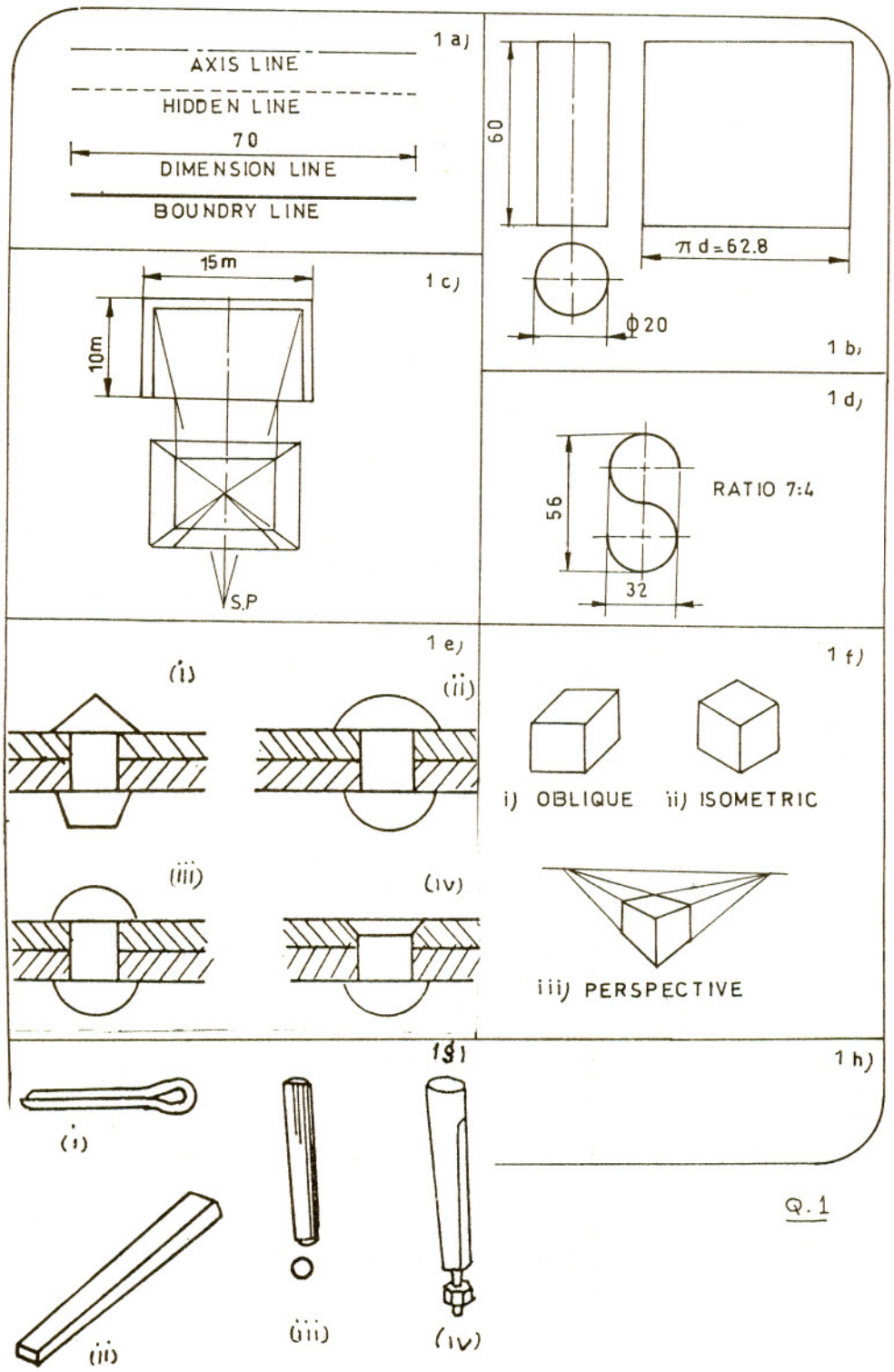
Q 6 A square prism, edge of base 30 mm and height 60 mm, resting on its base on HP, is completely penetrated by another square prism, edge of base 20 mm and 70 mm long , such that the axes of the two prisms bisect each other at right angles and the faces of both the prisms are equally inclined to the VP.

Draw the projections of the solids showing lines of intersection. 14

Section C: answer only one question from this section.

Q 7 Draw an ellipse by concentric circles or auxiliary circles method. The major and minor axes of the ellipse are to be 100 mm and 60 mm respectively. 14

Q 8 Draw a helix of 72 mm pitch for one revolution around a right circular cone of ϕ 60 and 72 mm height. Also show the helix in plan. 14




Q. 1

| | | |
|---|---|---|
| 1(e) | Fig (i) Lap Joint | Top rivet, conical head<br>Bottom rivet, pan head. |
| | (ii) Lap Joint | Top rivet, button head<br>Bottom rivet, snap head |
| | (iii)Lap Joint | Both top and bottom rivets<br>snap head |
| | (iv)Lap Joint | Top rivet, counter sunk head<br>bottom rivet, snap head. |
| 1(g) | (i) Split Pin | Taper less |
| | (ii) Rectangular key | Taper 1:100 |
| | (iii)Dowel | Taper less |
| | (iv)Cotter Pin | Taper 1:30 to 1:40 |

1(h) Scale. : Scale is measuring instrument for length

$$\text{Representative Fraction (R.F)} = \frac{\text{Distance on Drawing}}{\text{Actual Distance}}$$

Reducing Scale: Scales having R.F less than 1.e.g. 1:2

---

Q.4 Assume the prism to be resting on its base in the H.P and two base edges parallel to the V.P. . For projections begin with the top view and project up the front view. Name the key points of the hole and the prism, as shown in the figure.

Now tilt the solid about the corner A,till the axis makes $30^0$ angle with xy. In this position the axis will remain parallel to V.P and inclined at $30^0$ to H.P.

Reproduce the front view to new position with $a^1$ on xy.

Draw the vertical projectors from the new front view and horizontals from top view to project the required top view. Complete the new top view as shown in figure.

---

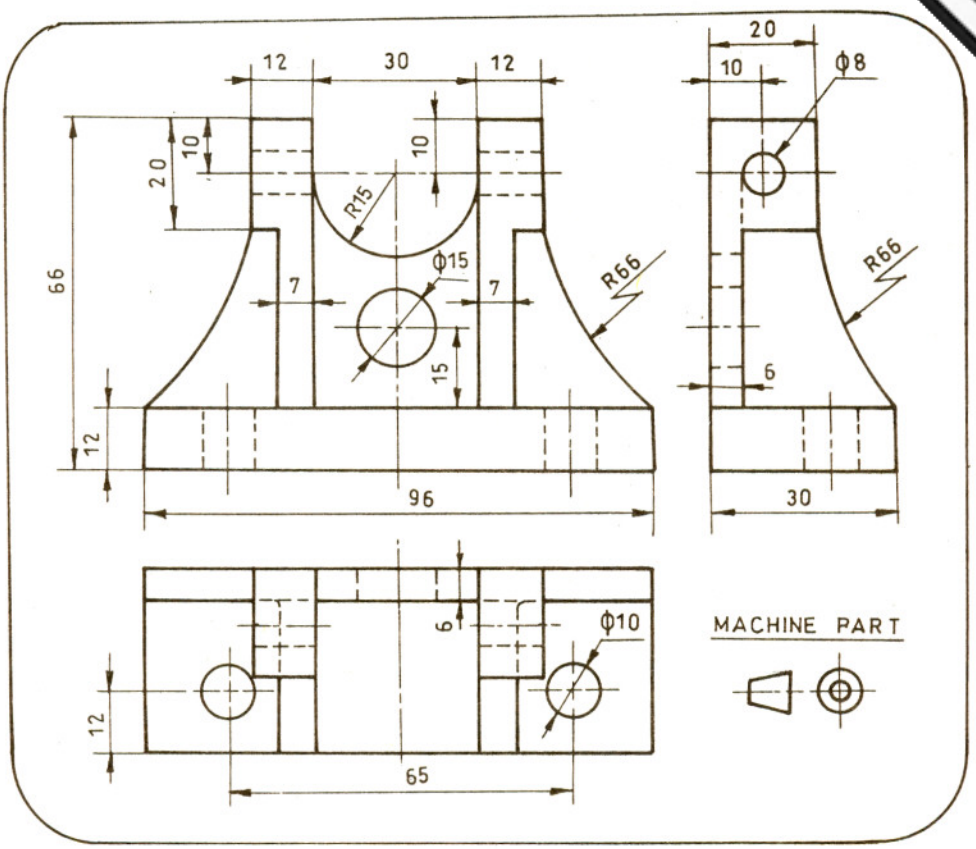
Q.5 Assume the pyramid resting on its base with one base side perpendicular to the V.P.

Begin with the top view and then project its front view. Name the apex and the base corners as shown in figure.

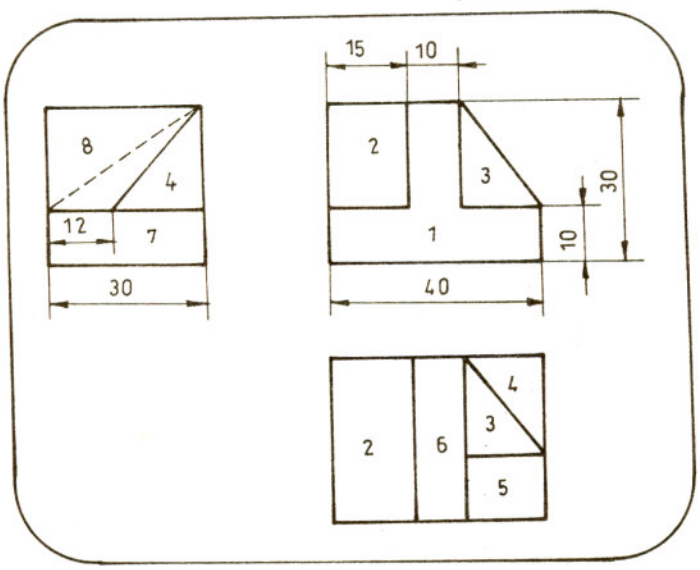
Thc scction planc will bc scen as a linc in front vicw. Hcncc draw a linc V.T through the mid points of the axis and inclined at $45^0$ to *xy*. Name the points of intersection of the sloping edges with the V.T.

Project the point of intersections in the top view on the corresponding edges. Complete the section 1,2,3,4,5 by joining the points and draw section lines in this area.

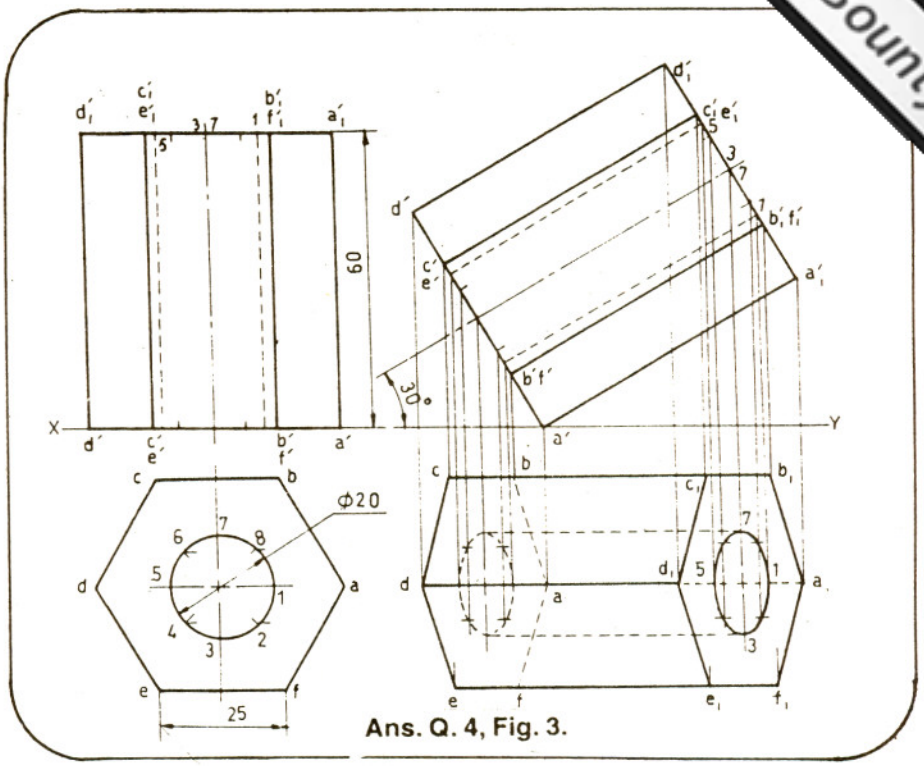
Assume the V.T to a new reference line. Project 1",2" etc at $90^0$ to V.T and plotting the distance of the points equal to distances of points from *xy*, as shown in the figure, thus giving true shape of section.



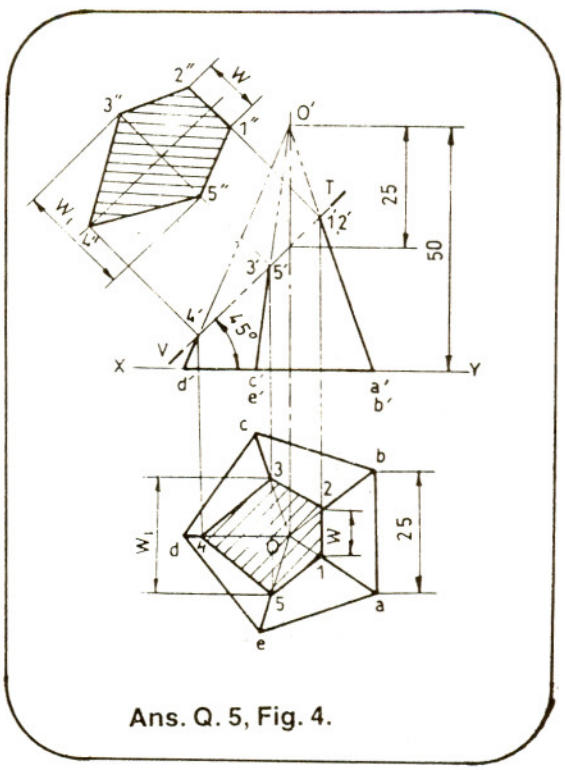

Q2




Q3




Ans. Q. 4, Fig. 3.




Ans. Q. 5, Fig. 4.

Q.6 Draw the projections of the prism in the required position as shown
The faces of the vertical prism are seen as lines in the top view. First lo
points of intersection in top view and the corresponding points in the side
Lines 1-1 and 3-3 intersect the edges of the vertical square prism in the point
and $P_3$. Lines 2-2 and 4-4 intersect the faces at $P_2$ and $P_4$ respectively.
The exact positions of these points along the length of the prism may now be determined by projecting them on the corresponding lines in the front view. For example, $p_2$ is projected to $p_2^1$ on the line 2'-2'. Note that $p_4^1$ coincides with $p_2^1$. Draw the lines $p_1^1\ p_2^1$ and $p_2^1 p_3^1$. Lines $p_1^1 p_4^1$ and $p_3^1 p_4^1$ coincides with front lines. These lines show the lines of intersection. Lines $q_1^1 q_2^1$ and $q_3^1 q_4^1$ on the other sides are obtained in the same manner. Note that the lines for the hidden portion of edges are shown as dashed lines.

---

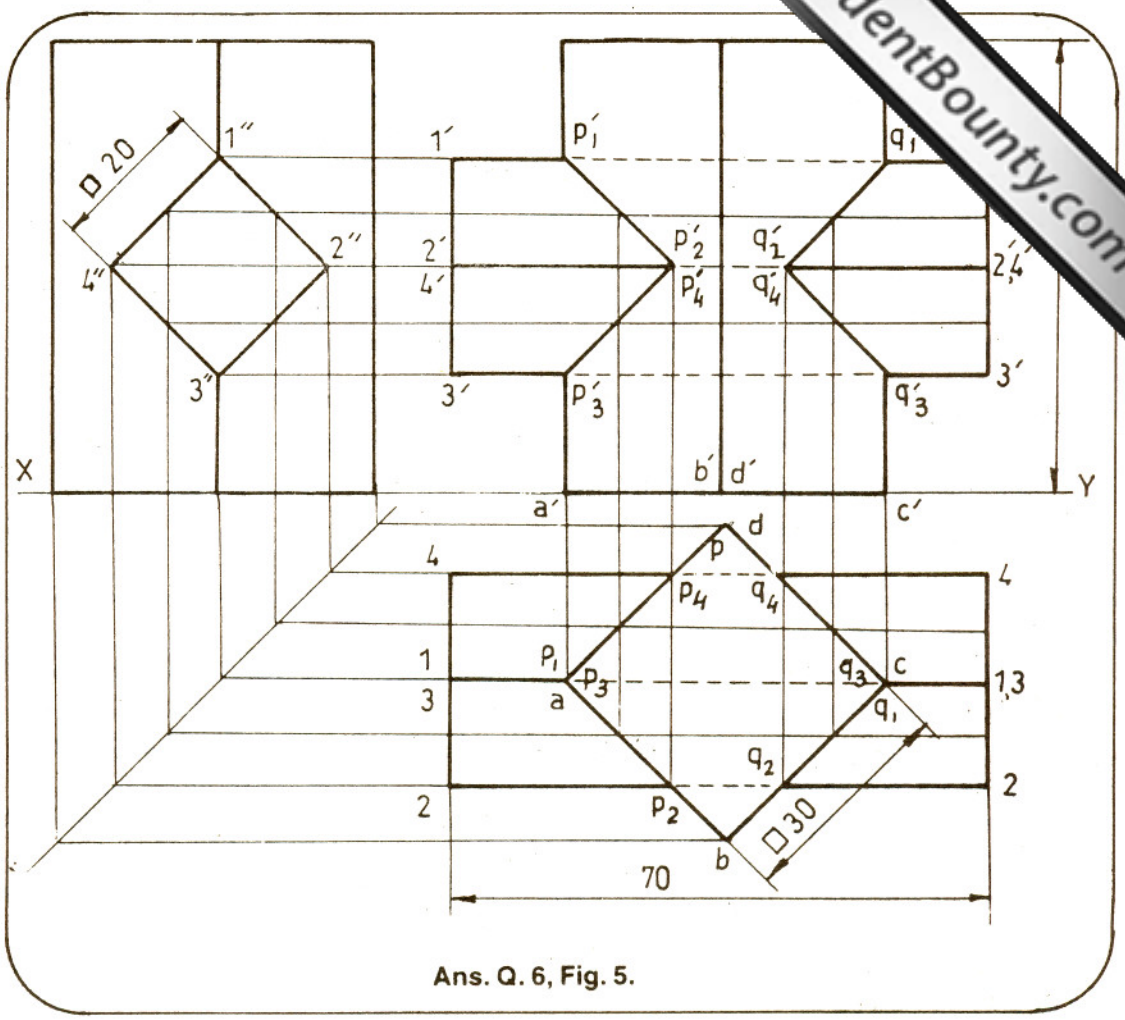
Q.7

With center O and diameters AB = 100 mm and CD = 60 mm respectively draw two concentric circles.
Divide the major axis circle into a number of equal divisions, say 12 and mark points 1,2 etc. as shown.
Draw lines joining these points with center O and cutting the minor axis circle at points 1',2' etc.
Through the point 1 on the major axis circle draw a line parallel to CD, the minor axis. Through point 1' on the minor axis circle, draw line parallel to AB, the major axis. Where these two lines intersect, is the point $P_1$, which is a point on the required ellipse
Repeat the construction. Through all points draw the ellipse through $A, P_1, P_2$ etc.

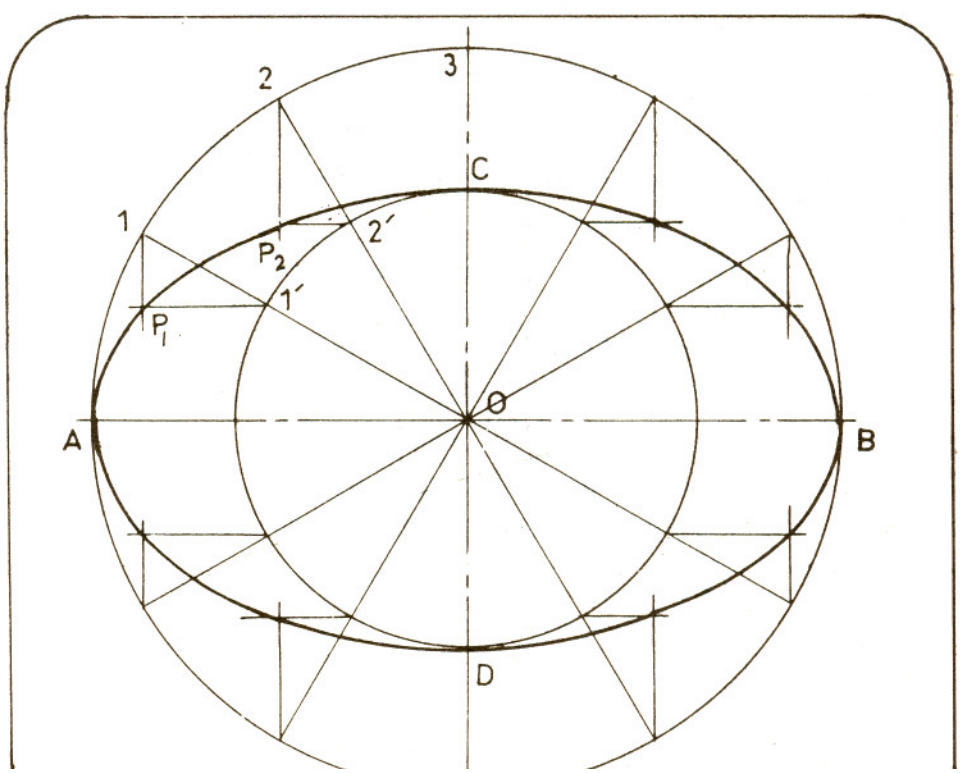
---

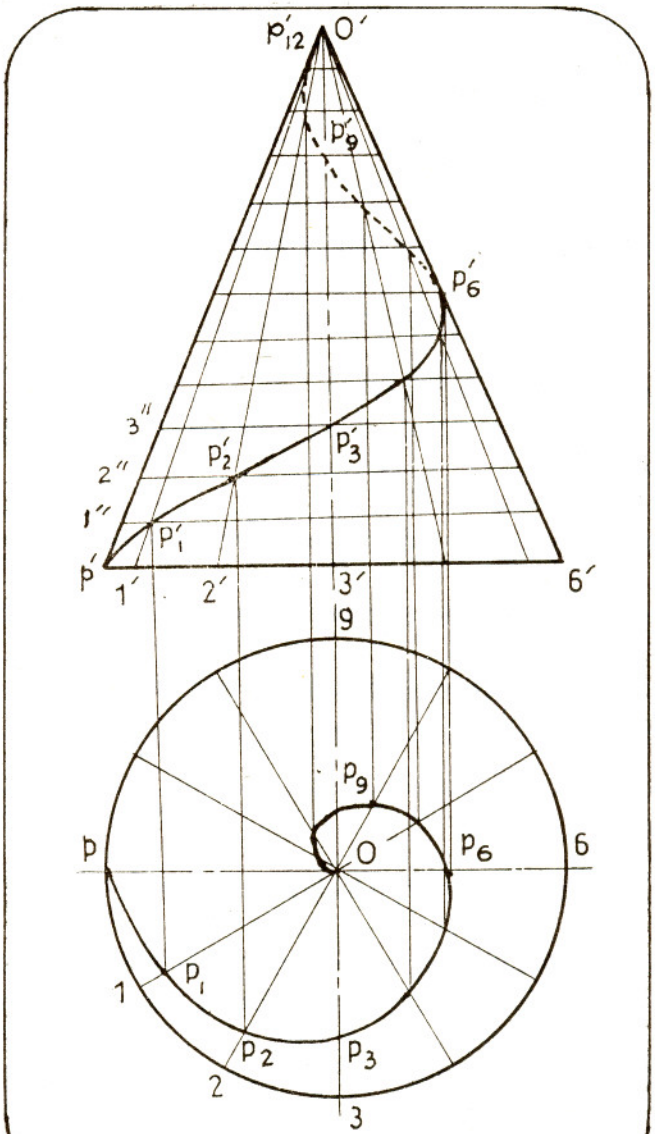
Q.8

Draw the projections of the cone in vertical position, as shown in figure. Divide the circle into 12 equal parts and join points 1,2 etc with O.
Project these points to the base line in front view as $1^1, 2^1$ etc. and join them with $O^1$. Divide $O^1 - 3^1$ also into 12 equal parts and draw horizontal line through these points.
Let P be the starting point. When it has moved through $30^0$, it will have moved up through one division to a point $P_1^1$ on the generator $O^1 1^1$, on horizontal line drawn through $1^{11}$. This point will be on conical helix in the front view. Project $P_1^1$ to $P_1$ in top view on the corresponding generator O1. $P_1$ is the top view on the curve. Obtain all other points in the same manner and draw smooth curve through them in both the views.




Ans. Q. 6, Fig. 5.






Ans. Q. 8. Fig. 7.

SUBJECT : ENGINEERING GRAPHICS / ENGINEERING DRAWI 000)

CODE No.A-02(N)/A-02(O)/C-02 TIME : 3 HOURS MAX MARKS

NOTE :

i). This paper has 9 questions in all arranged in three sections A, B, & C.

ii) Section A contains 2 questions. Both are compulsory.

iii) Q1 is to be answered on Answer Sheet specially provided for the purpose. Detach the answer sheet and attach it to main drawing sheet which is to be used for answering question No.s 2 to 8.

iv) Any missing dimensions may be suitably assumed and recorded on the answer sheet

v) Retain all construction lines in the answers on Plane and Solid geometry questions.

v) Follow code of engineering Drawing practice IS 696/SP-46. 1988. Neat and accurate drafting is necessary.

## SECTION A (COMPULSARY)

Q1 is a multiple choice, objective type question. Indicate your answer by putting the mark X on the option given which you consider is correct or the most correct.

i) Which one of the following diagrams depicts, as per convention, A CUTTING PLANE LINE?

(A) ————————

(B) — — — — — — —

(C) ————/\————

(D) —— · —— · ——

C

ii) Which one of the following is an example of VERTICAL ROMA

(A) **a** A

(B) H

(C) H

(D) h

iii) Which one is not the correct method to indicate dimensions?

(A) 

(B) 

(C) 

(D)  D

iv) Which one is the correct representation of RF as used in the concept of scales?

(A) Representive fraction A

(B) Reduced Fraction

(C) Repetitive Fraction

(D) Round Fraction

v) Which is true for a vernier scale?

(A) It can measure very small units with great accuracy A

(B) It can measure a number of very small units simultaneously

(C) It is a plain scale

(D) It is a combination of a diagonal and plain scale.

vi) A square pyramid has

(A) 6 surfaces

(B) 5 surfaces

(C) 1 square surface and 4 triangular surfaces and C

(D) 4 surfaces and 1 triangular surface

vii) The terms FOCUS, VERTEX, CHORD, & LACTUS RECTUM are

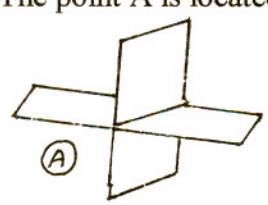
(A) Common to Parabola, Ellipse, and Hyperbola

(B) Common to Parabola and Hyperbola only B

(C) Exclusive to ellipse only

(D) Not applicable to any one of the Parabola, Ellipse, and Hyperbola

viii) In the figure
The point A is located in




(A) 1st angle

(B) 2nd angle

(C) 3rd angle C

(D) In none of the angles

ix) In perspective a circle is shown as

(A) Circle

(B) Ellipse B

(C) Parabola

(D) Volute

x) In a perspective

(A) The height of an object changes

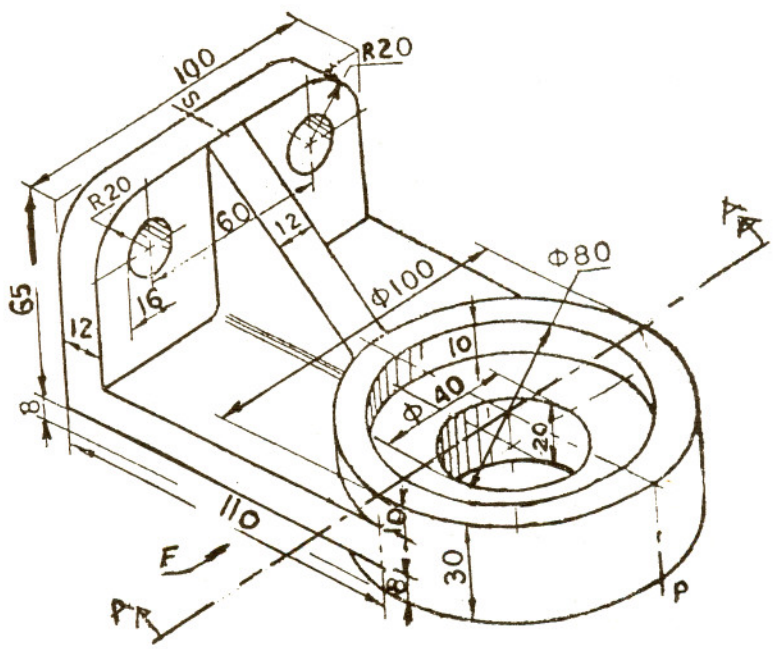
(B) The height of an object gets reduced

(C) Both the height and surface of an object are shortened

(D) The height and surface remain as per their true dimensions. (2×10)

Q2 Figure 1 shows the pictorial view of a bracket. Using a suitable reducing scale Draw the following views in first angle projection system.

a) Top view of the bracket (14)
b) Sectional view of the bracket looking toward A, assuming the section plane as AA (16)
c) Give 10 important dimensions (5)




**SECTION B**

Attempt any TWO questions from this section. Each question carries 15 marks. Do not rub off construction lines. Provide adequate labelling and dimensions in a neat clear manner.

Q3 Figure 2 depicts three orthographic projections of a regular hexagonal prism standing centrally on one of its hexagonal faces over a square base. Draw the isometric view of the arrangement of the two given solids.

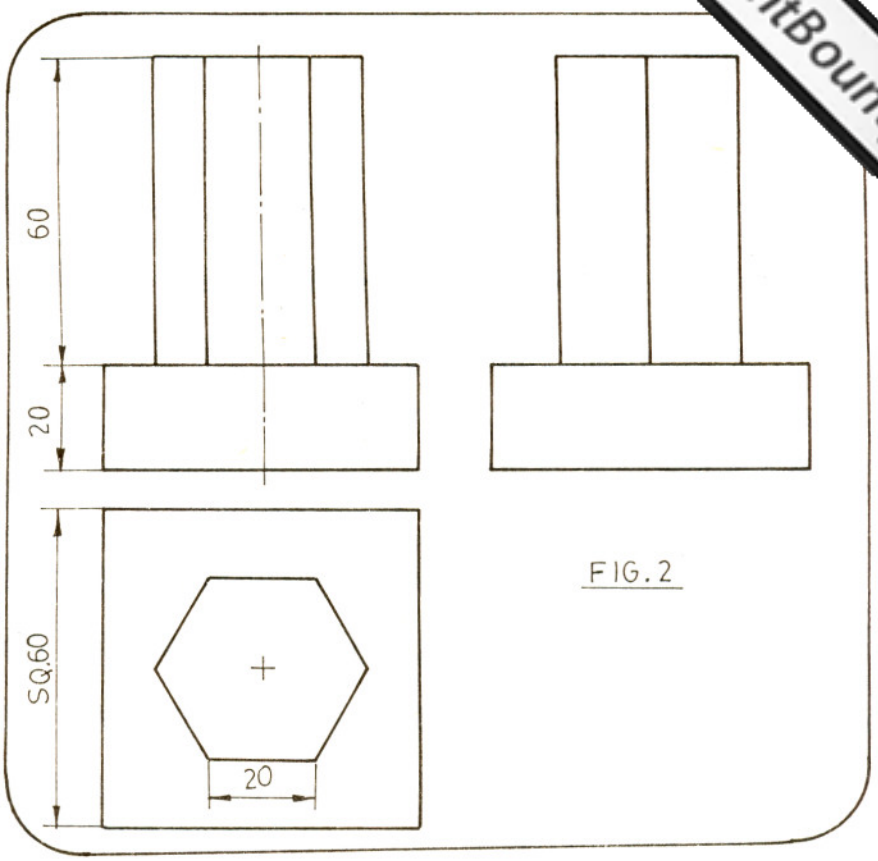



FIG. 2

Q4 A sphere of ϕ 60 mm is cut by a section plane perpendicular to a V.P. inclined at $45^0$ to HP and is at a distance of 20 mm from its centre.
Draw the sectional top view and (7)
Sectional front view of the sphere (7)
Give dimensions (1)

Q5 A line CD, 45 mm long, has its end C 15 mm below HP and 10 mm behind VP. End D is 40 mm below the HP and 45 mm behind the VP. Draw the projections and determine the inclination with V.P. and H.P. (12,3)

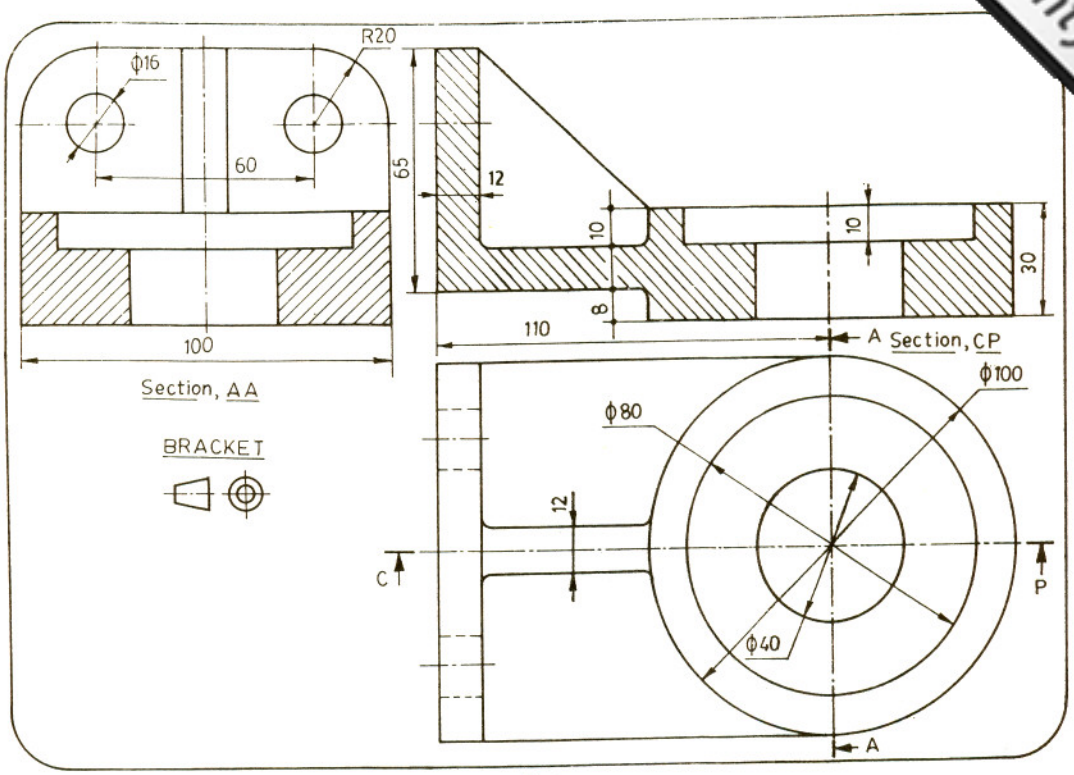
Q6 Sketch two views of a double riveted double cover butt joint for joining two plates 16mm thick. Give dimensions. (8,7)

## SECTION C

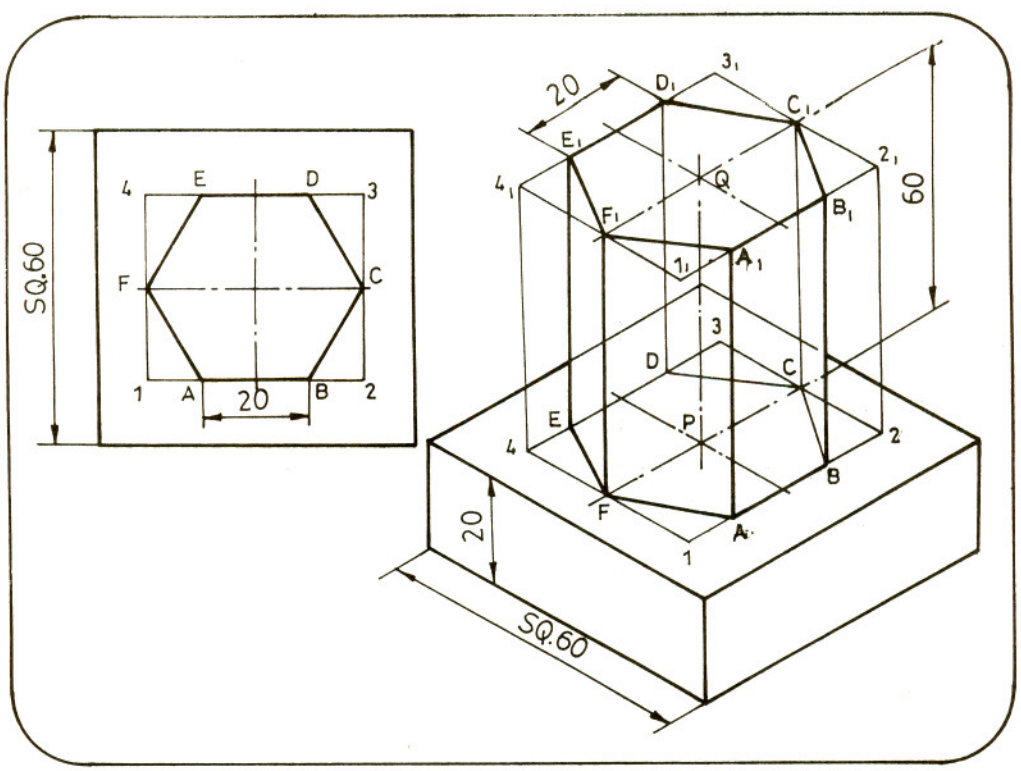
Attempt any ONE question from this section. Each question carries 15 marks.

Q7 Draw an ellipse using auxillary circles method. Assume the major axis as 120mm and minor axis as 60 mm
Neatly give dimensions (12,3)

Q8 Draw the involute to a circular ARC which subtends an angle of $90^0$ at the circle of ϕ 150 mm (15)




Q 2



Q.4

(i) Draw the projections of sphere of 60 mm diameter.

(ii) Draw the line V.T for the section plane at $45^0$ to xy and tan... arc of 20 mm radius drawn with $O^1$ as the center.

(iii) Select number of points on cutting plane V.T enclosing within th... like a', b', c', d' and e'. Pass number of the horizontal slices like 1-1... 3-3 and 4-4 through these points .The section of these slices will be ci... of different diameters in top view. Draw these circles with center O.

(iv) Find the width of section of each point in top view as shown in the figure: For example the chord $c\text{-}c_1$, is the width of the section at point c. Similarly obtain other points and draw the curve through these points thus obtained. It will be an ellipse. Show the section lines in the ellipse.

---

Q.5.

(i) As per the given position draw the loci ef and gh of the end C and pq and rs of the end D.

(ii) Mark any point c (the top view of C) in gh and project it to $c^1$ on ef. With $c^1$ as center and radius 45mm draw an arc cutting pq in point $d_1'$. Join $c^1$ with $d_1'$. $\theta$ is the inclination of c' $d_1'$ with *xy*.It is the inclination of CD with the H.P. Project $d_1'$ to $d_2$ on gh, c $d_2$ is the length of the line in top view.

(iii) With c as the center and radius 45mm,draw an arc cutting rs in point $d_1$. Join $d_1$ with c, $\phi$ is the inclination of c $d_1$ with *xy*. It is the inclination of CD with V.P.Project $d_1$ to $d_2^1$. $c^1d_2^1$ is the length of line in front view.

(iv) Arrange $cd_2$ and $c^1d_2^1$ between their respective paths as shown, $c^1d^1$ and cd are the required projections of CD.

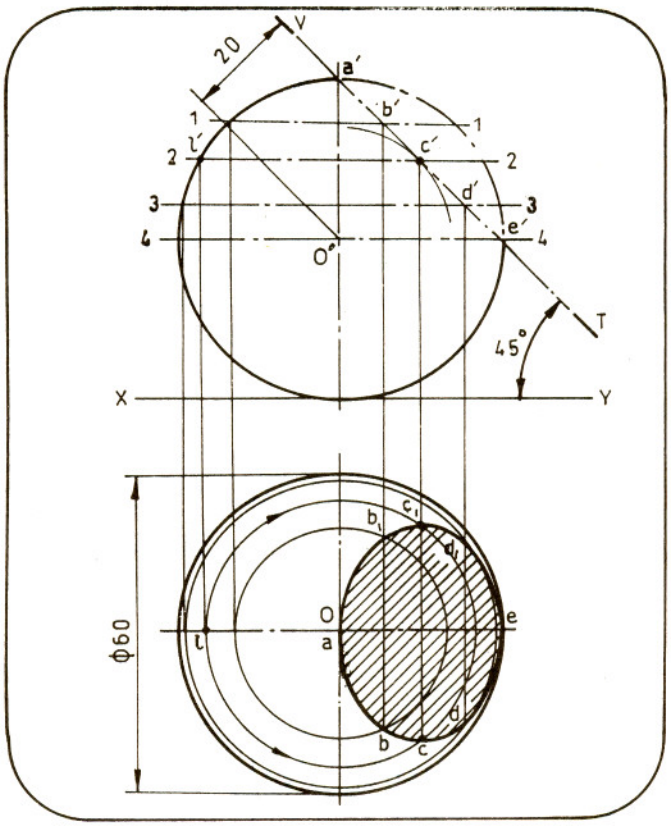
---

Q.7 (i) Draw the major axis AB= 120mm and minor axis CD = 60mm intersecting each other at O.

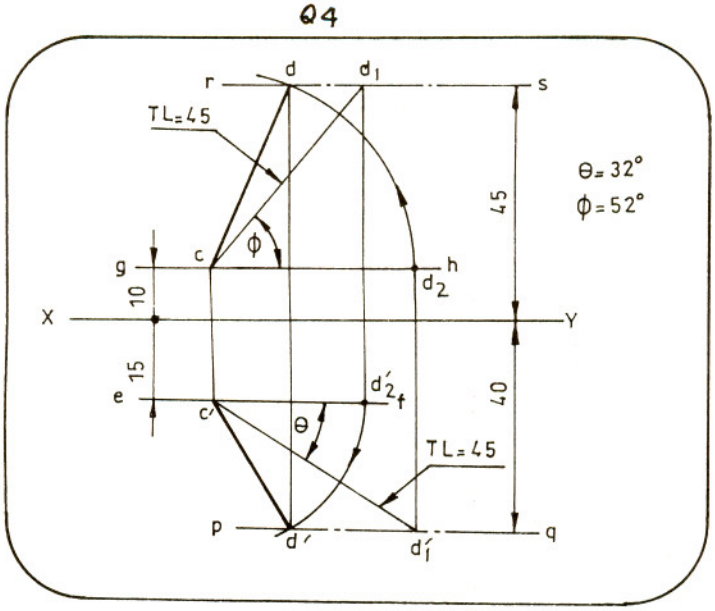
(ii) With center O and diameters AB and CD respectively, draw the two circles.

(iii) Divide the major axis circle into a number of equal divisions, say 12 and mark points 1', 2' etc. as shown.

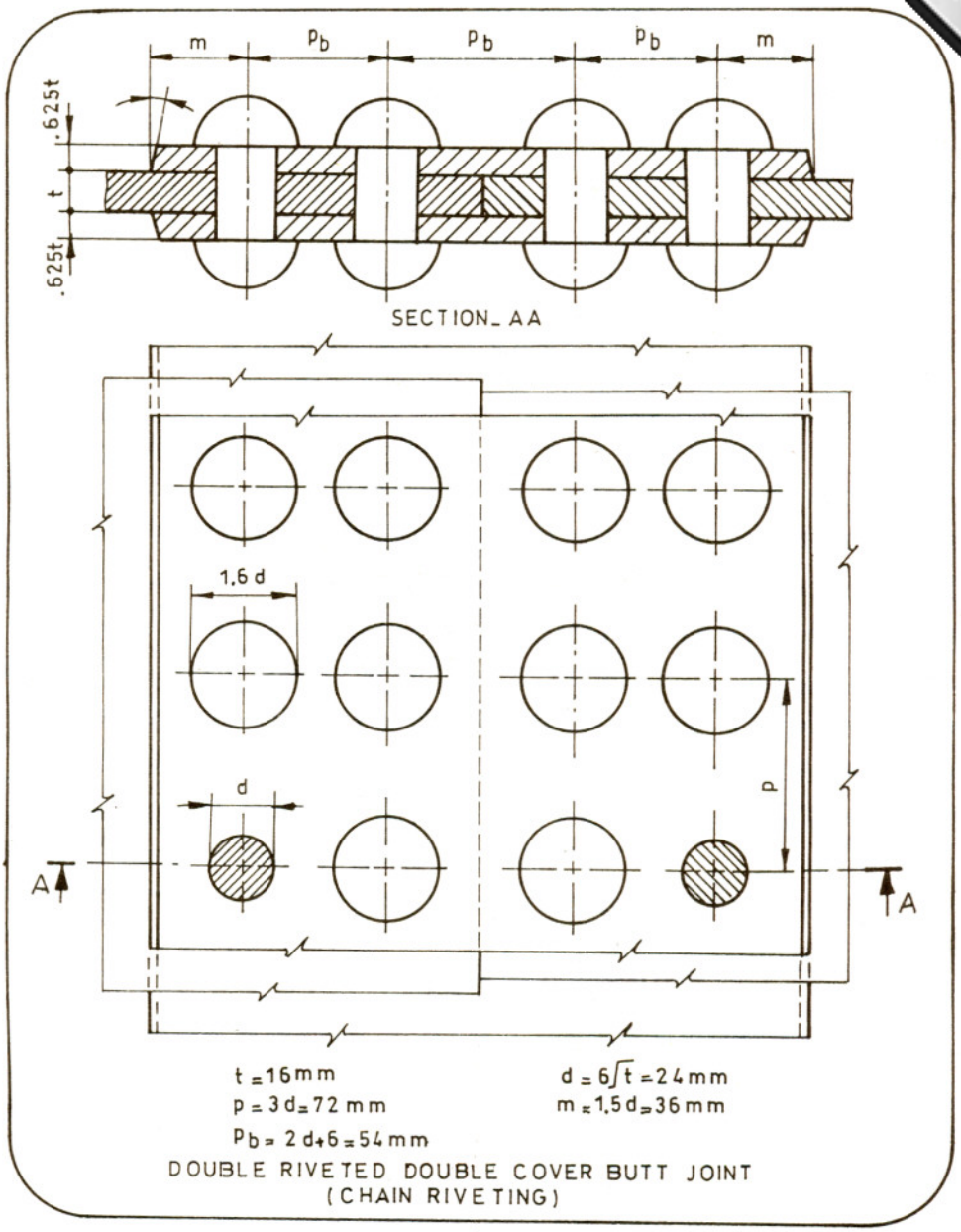
(iv) Draw lines joining these points with center O and cutting the minor axis circle at points 1,2 etc. Through the point 1 on the major axis circle draw a line parallel to the CD.(the minor axis) Through point 1 on the minor axis circle draw a line parallel to AB, (the major axis) .The point $P_1$ where these two lines intersect is on the required ellipse. Repeat the construction through all thc points. Draw thc cllipsc through thc $A, P_1, P_2$..... etc




Q4




Q5




$t = 16\,mm$ $\quad d = 6\sqrt{t} = 24\,mm$

$p = 3d = 72\,mm$ $\quad m = 1.5d = 36\,mm$

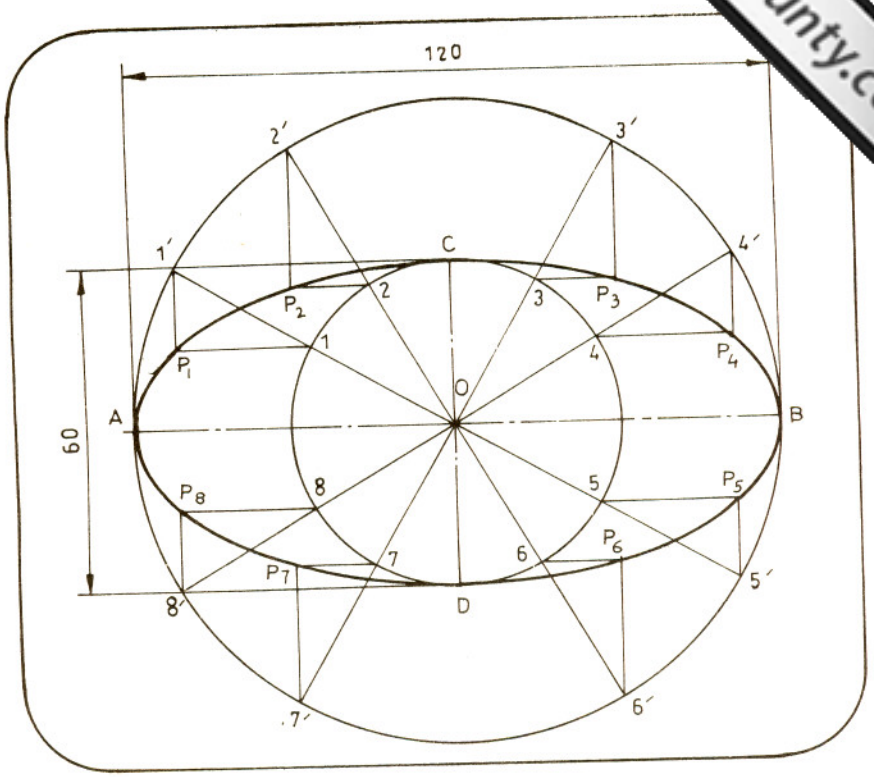
$p_b = 2d + 6 = 54\,mm$

DOUBLE RIVETED DOUBLE COVER BUTT JOINT
(CHAIN RIVETING)

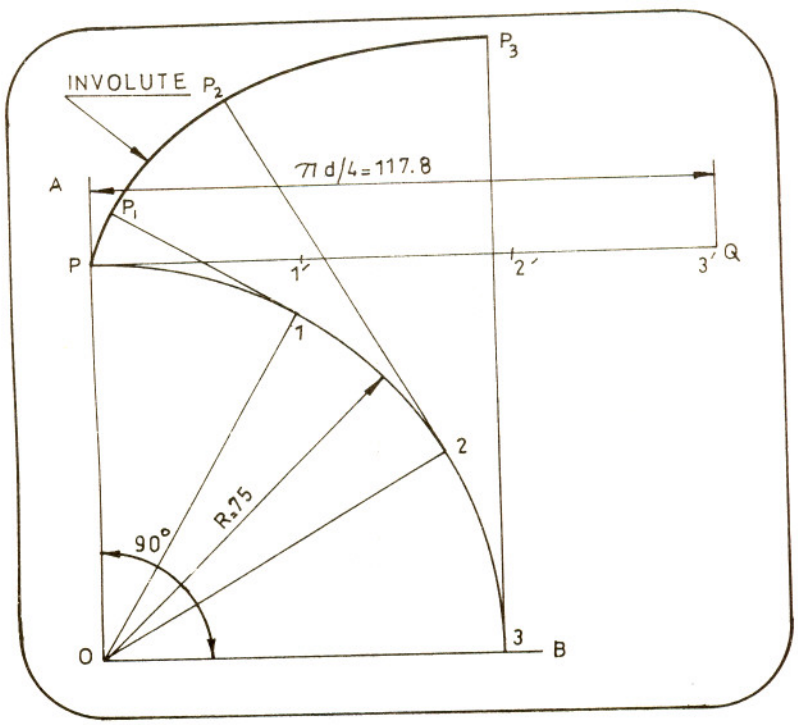
Q6

Q.8 (i) Draw two lines OA and OB at right angles. With O as ce ius 75mm draw a quarter circle, as the in volute of this arc is to d.

(ii) Draw the line PQ tangent to the arc and equal to the one fourth circumference of the circle of 150mm diameter. This will be equa $\frac{\pi \times 150}{4} = 117.8mm$, Divide PQ and arc into same number of the equa parts say 3. Draw tangents at point 1,2 and 3, and mark points on them $P_1, P_2, P_3$ such that $1P_1 = P1^1$, $2P_2 = P2^1$, and $3P_3 = P3^1$. Draw the involute through the points $P_1, P_2, P_3$.as a smooth curve.




Q7




Q8

SUBJECT: ENGINEERING GRAPHICS / ENGINEERING DRAWING ( )

A-02/C-02 TIME: 4 HOURS MAX MARKS 100

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Note:
1. This paper has 8 questions in all arranged in 3 sections, i.e. A, B, & C.
2. Section A has two questions both are compulsory.
3. Use only one drawing sheet, use both sides if required
4. Attempt 2 questions from section B and one question from section C
5. Assume suitable value of any missing dimensions or data and state the same.

---

SECTION A (compulsory)

---

Q1 Choose the correct or best alternative in the following: (2 × 8)

a. Diagonal scales are used for measurement of

(A) One unit (B) Two units

(C) Three units (D) Four units C

b. In the first angle projection, the object is imagined to be placed

(A) Above H.P. & behind V.P. (B) Above H.P. & in front V.P. B

(C) Below H.P. & behind V.P. (D) Below H.P. & in front V.P.

c. In a full sectional view, the object is imagined to be cut off

(A) One third (B) One half

(C) One fourth (D) Full D

d. The isometric projection of a circle is represented as ellipse of the object in

(A) All faces (B) Only the front face A

(C) Only the top face (D) Only side face

e When the line is parallel to both the H.P. & V.P it has
(A) H.T. (B) V.T.

(C) No trace (D) Both H.T. & V.T.

f. The shortest distance from a point to the plane is seen in the
(A) Front view (B) Top view

(C) Edge view (D) Both Front View & Top View C

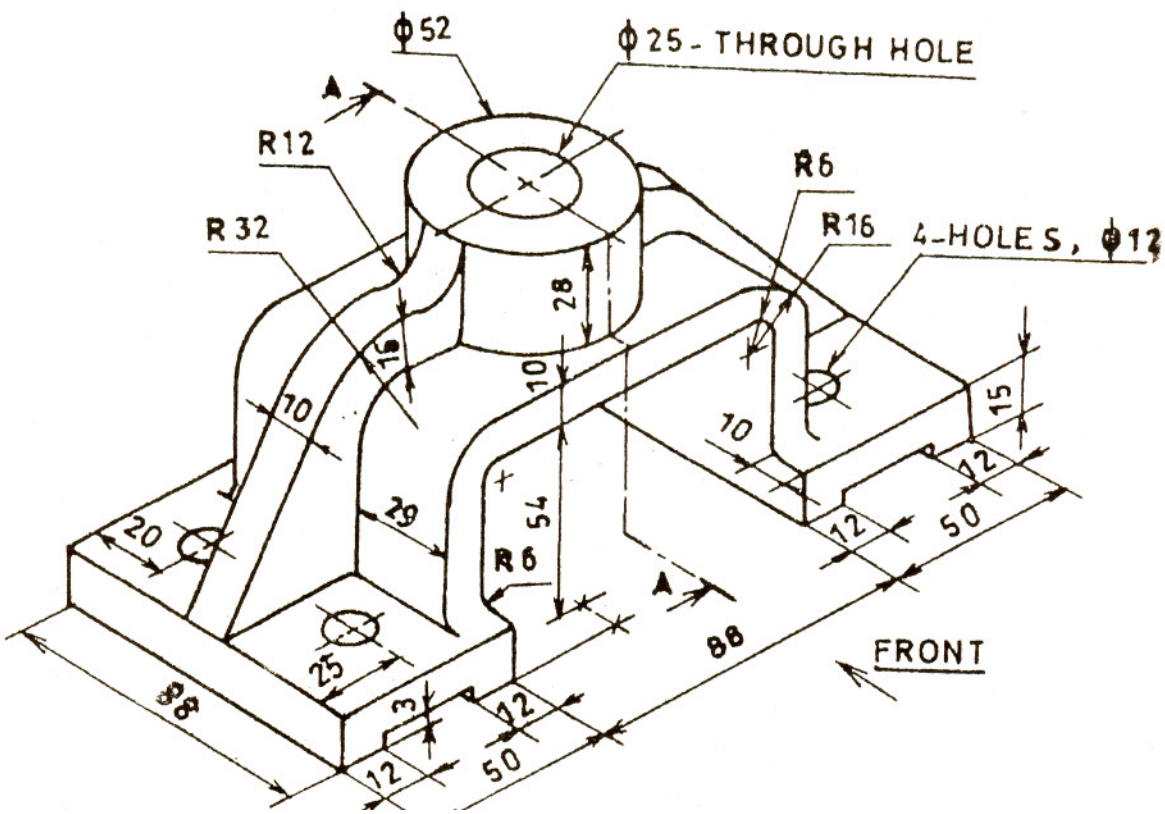
g. When two intersecting cylinders are of the same diameter, the line of Intersection will be
(A) Two curved lines (B) Two straight lines B

(C) One curved & one straight line (D) four curved lines

h. The traces of plane
(A) Planes (B) Straight lines B

(C) Point (D) Curved lines

Q2 Fig 1 (on page 3) shows a casting. Draw the following views
a) Front view (10)
b) Sectional side view through A-A (15)
c) Top view (8)



## SECTION B

Attempt any 2 questions from this section. Each question carries 17 marks

Q3 A line AB 60 mm long makes $45^0$ and $30^0$ angles with the V.P. and H.P respectively. Draw the projections and draw its traces when the end point A is 10mm in front of the V.P and 20 mm above the H.P..

Q4. A pentagonal prism, edge of the base 25mm and axis 50mm long is resting on one of its corners of its base on the horizontal plane with its axis inclined at $45^0$ to the H.P.and parallel to the V.P, draw the projections of the prism.

Q5 Fig. 2 shows the two views of an object. Draw the isometric projection

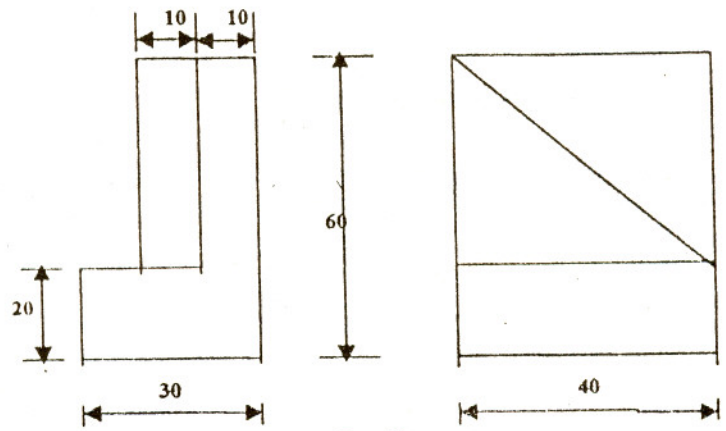



FIG-2
Not to scale

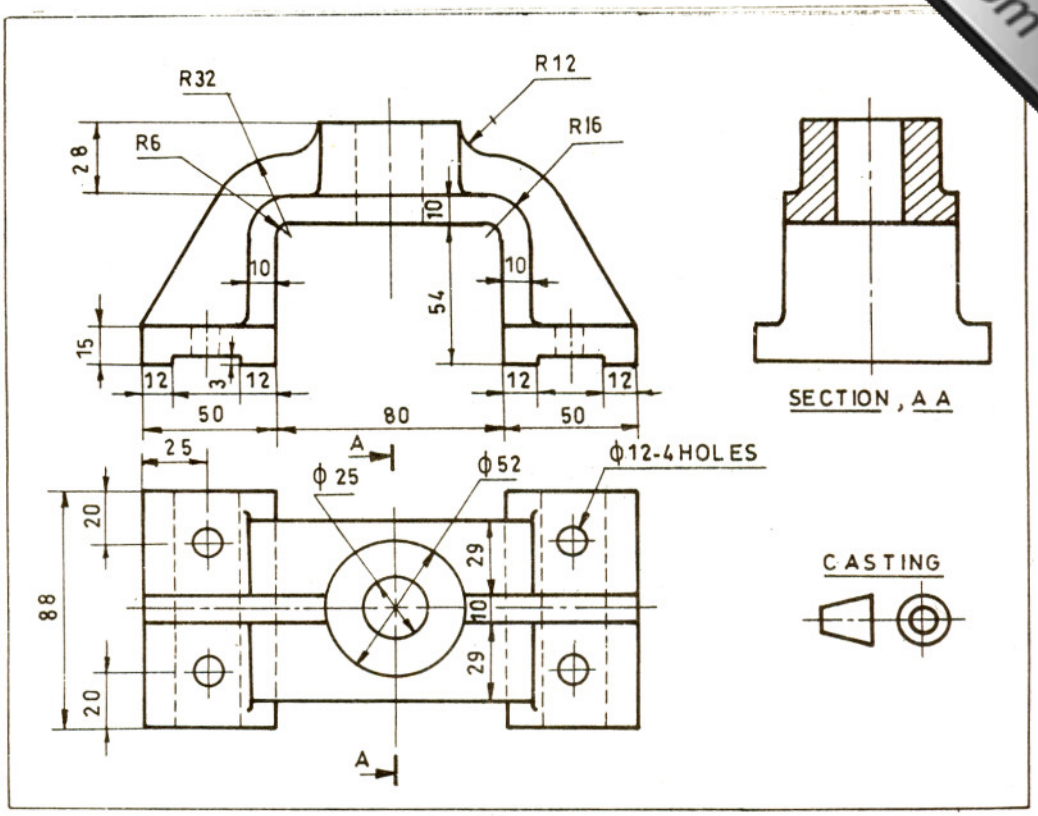
Q6 A right regular pyramid base 30mm, axis 65mm long has its base on the horizontal plane and an edge of the plane parallel to the V.P. An auxiliary inclined plane perpendicular to the H.P. and inclined at $45^0$ to the V.P. cuts the solid at a distance 2mm from the axis. Draw its sectional front view and true shape of the section.

## SECTION C

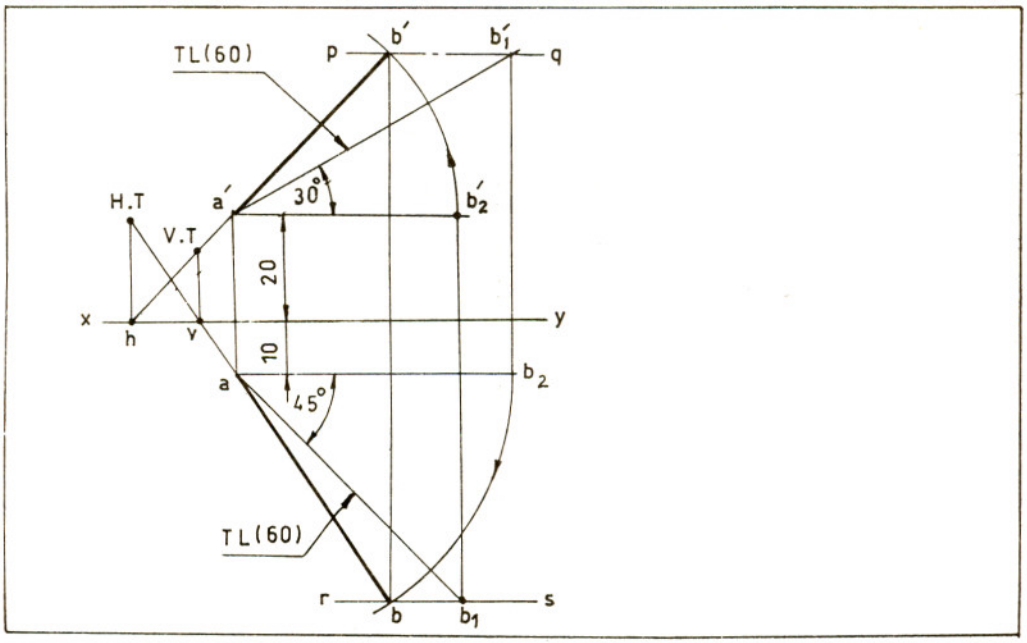
Attempt any ONE question from this section. Each question carries 17 marks

Q7 Draw an epicycloid given that radii of the generating and directing circle as r = 20mm and R = 72 mm respectively. Also draw the normal and tangent at any point on the curve.

Q8 Draw an involute of a given circle of diameter 25mm. Draw also the normal and tangent at any point on the curve.




Q2




Q3

Q.3

A is 10 mm in front of the V.P and 20 mm. above the H.P.

(a) To draw the projections

(i) First locate $a^1$ ,20 mm above $xy$ and $a$ 10 mm below $xy$ .

(ii) Draw $a^1b_1^1$ at $30^0$ to $xy$ and equal to 60mm

(iii) Obtain plan length as $ab_2$ .

(iv) Mark locus of elevation of B as $pq$, parallel to $xy$ from $b_1$

(v) Draw $ab_1$ at $45^0$ to $xy$ and equal 60 mm.

(vi) Obtain its elevation length as $a^1b_2^1$.

(vii) Locate $b^1$ on pq by $a^1b_2^1$, keeping $a^1$ as the center and radius $a^1b_2^1$. join $a^1b^1$ .

(viii) Locate b on locus line rs either with $a$ as center and radius $ab_2$ or by drawing vertical projections through $b^1$. Join $a$ with $b$. $a^1b^1$ and $ab$ are the final projections.

(b) To find H.T and V.T

(i) Produce final elevation $a^1b^1$ to meet in $xy$ line at point h. Erect a perpendicular line through h to meet the plan line ab produced. This point will represent H.T.

(ii) Produce final plan $ab$ to meet $xy$ line in point v. Erect a perpendicular line through v to meet the elevation line $a^1b^1$ produced. This point will represent the V.T.

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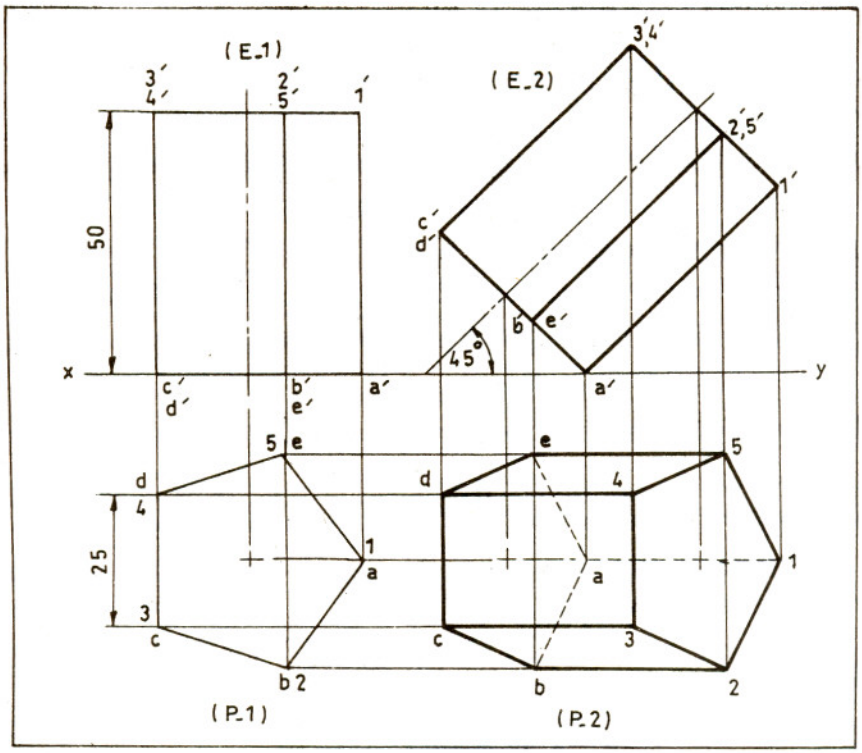
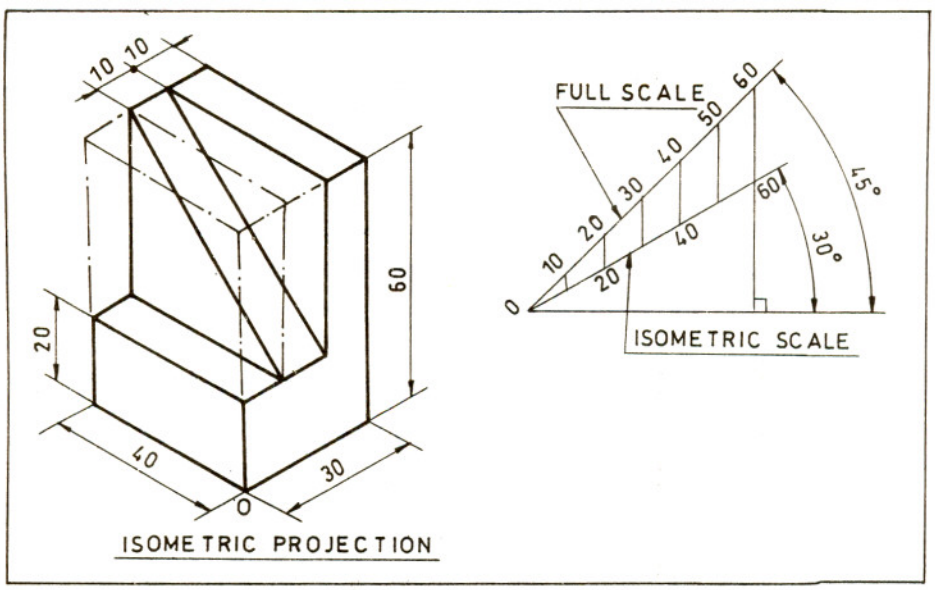
Q.4 (i) Assume the prism with axis perpendicular to the H.P and base on the H.P. Draw the plan (P-1) keeping CD and the corner A, parallel to $xy$. Project elevation (E-1) from this view.

(ii) Reproduce (E-1) to (E-2), keeping A (elevation $a^1$) on $xy$ and making axis $45^0$ to $xy$. In this position, the axis will remain parallel to the V.P.

(iii) Complete plan (P-2) by drawing vertical projectors from (E-2) and horizontals from (P-1), as shown in figure.




Q4




Q5

Q.5 (i) Draw the isometric scale and convert the given dimensions in isometri lengths from this scale.

(ii) First point O is marked and two lines are drawn on either side at $30^0$ to the horizontal. A vertical line is drawn to show the height.

(iii) While drawing isometric projections, it is suggested to draw first the box which completely encloses the object with isometric dimensions and then shaping to the required shape

(iv) Required lines are made thick while the construction lines of the box are kept light.

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Q.6 (i) As per statement, pentagonal. pyramid is resting on its base in the H.P with one edge of the base parallel to the V.P. Therefore draw its top view i.e. a regular pentagon, with one side parallel to *xy*.

(ii) Project elevation from this view.

(iii) The cutting plane is perpendicular to the H.P and $45^0$ to the V.P and at a distance of 2mm from the axis. This cutting plane is shown by H.T in the top view. Mark the points of intersection of H.T with the base and slant edges of the pyramid, as *a, b, c* and *d*.

(iv) Project these points on the corresponding edges in the front view as *a', b', c'* and *d'*. Join these points by straight line and show the section lines in that area. Retained lines are made thick, removed lines are thin construction lines. This view gives sectional front view.

(v) For true shape of section assume ground line $x_1y_1$ parallel to H.T. and project the points *a, b, c,* and d on the $x_1y_1$. Take the distance of the points $a_1, b_1, c_1$ and $d_1$ equal to distances of $a^1, b^1, c^1$ and $d^1$ of elevation from *xy*. Join these points and show the hatching lines in this area at $45^0$ with $x_1y_1$.

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Q.7

(i) When rolling circle rolls by one revolution, it will advance on the directing circle equal to

$\pi d = \pi \times 40 = 125.66mm.$

(ii) An angle subtended for directing circle (fixed circle) of Radius R is calculatcd as follows:

$$\phi = \frac{r}{R} \times 360^0 = \frac{20}{72} \times 360^0 = 100^0$$

(iii) Draw an arc of radius $R = 72mm$ and subtending an angle of $\phi$ equal to $100^0$ at center O.

(iv) Draw rolling circle of radius $r = 20mm$ touching outside the fixed circle of radius $R = 72mm$.

(v) Consider the touching point as the starting point P.

(vi) Divide the rolling circle into 12 parts and mark them as $1^1, 2^1, \ldots\ldots, 12^1$.

(vii) Now with center O and radius equal to $01^1, 02^1, \ldots\ldots, 012^1$ . Draw arcs of sufficient lengths.

(viii) Draw arc with center O and OC as the radius to get the locus line of center C of rolling circle.

(ix) Divide the angle of $100^0$ into twelve equal parts and draw radial lines through O, as shown in the figure to intersect the locus line at $C, C_1, C_2 \ldots\ldots\ldots, C_{12}$ .

(x) With $C, C_1, C_2 \ldots\ldots\ldots, C_{12}$ . as centers and radius equal to 20 mm.draw arcs intersecting with arc lines through $1^1, 2^1, \ldots\ldots\ldots 12^1$ at points $P, P_1, P_2, \ldots\ldots\ldots P_{12}$ respectively as shown in figure.

(xi) Join $P, P_1, P_2, \ldots\ldots\ldots P_{12}$ in sequence by a smooth curve to get epi-cycloid.

(xii) Take any points N on the curve. With N as the center and radius =20mm, draw an arc to cut the locus line of center C in point Q. Join Q with O. Let it cut the fixed circle in point S. Join S with N and produce to $N_1$. $NN_1$ is the required normal. At N draw $TT_1$ at $90^0$ to $NN_1$ to get the tangent point N

---

Q.8

(i) Draw a circle of 25 mm diameter and divide it into 12 equal parts and mark them as 1,2,3…12.

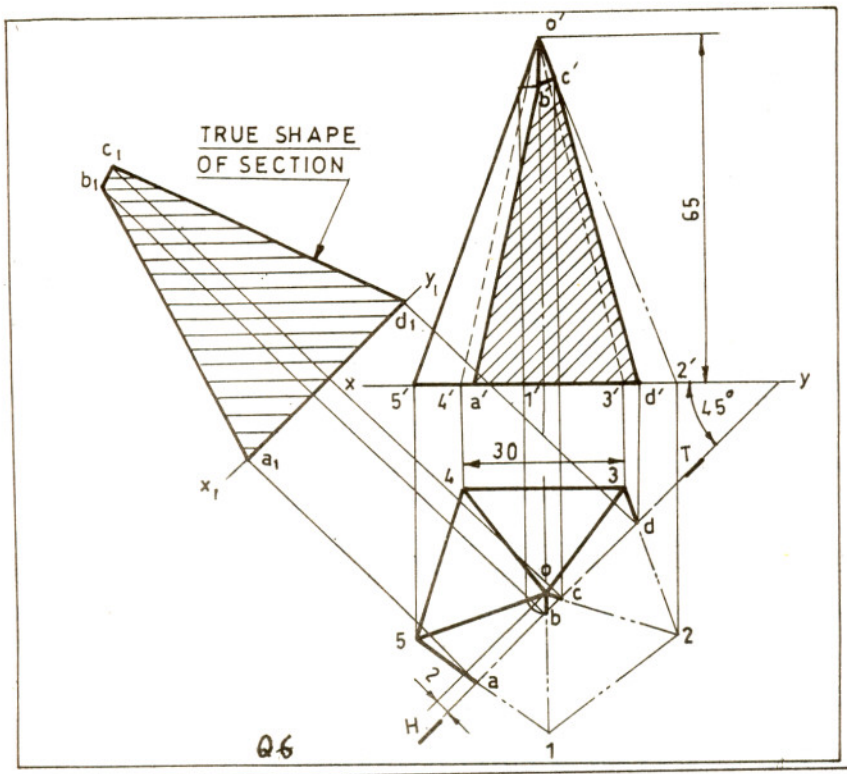
(ii) Draw a line of length equal to the circumference of the circle as $\pi d = \pi \times 25 = 78.5mm$ and tangent to the circle. Divide this line into 12 equal parts and mark them as $1^1, 2^1, \ldots\ldots, 12^1$

(iii) Draw tangents to the circle at points 1,2…12 in the direction of the position of string during winding.

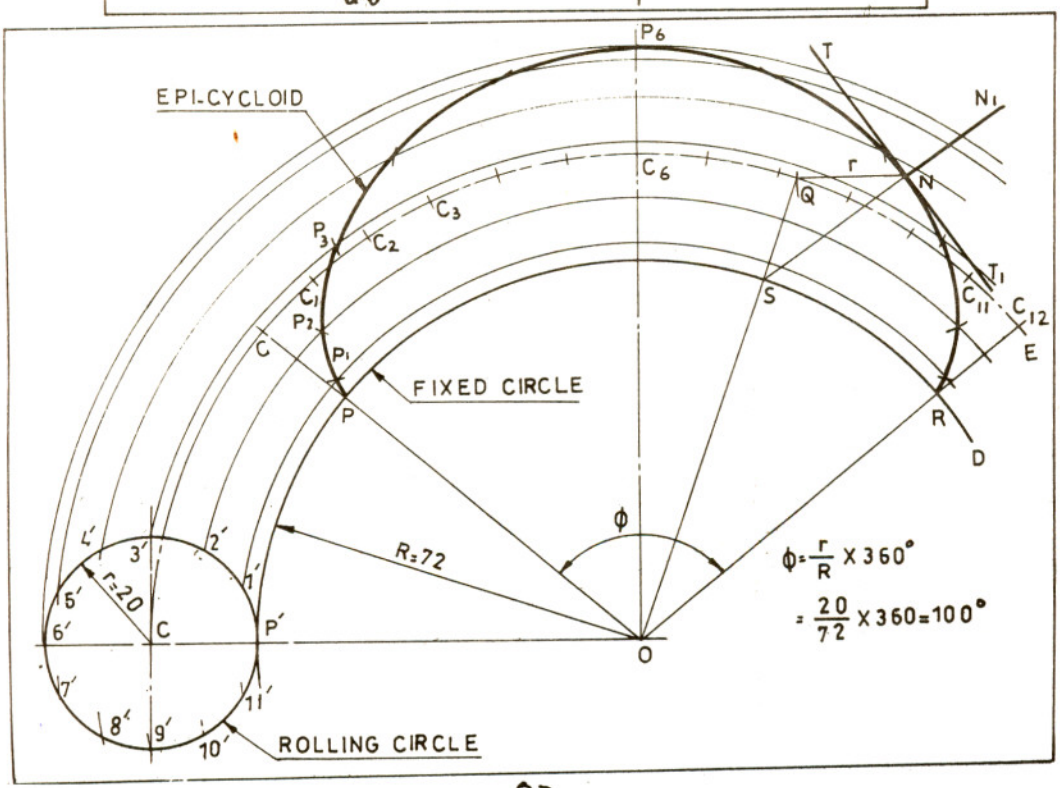
(iv) On tangents at point 1,2…12 take length equal to the $1^1P, 2^1P, \ldots\ldots 12^1P$ to mark points $P_1, P_2, \ldots . P_{12}$ respectively

(v) Join points $P, P_1, P_2 \ldots . . P_{12}$ by smooth curve to get the involute of a circle as shown in figure.

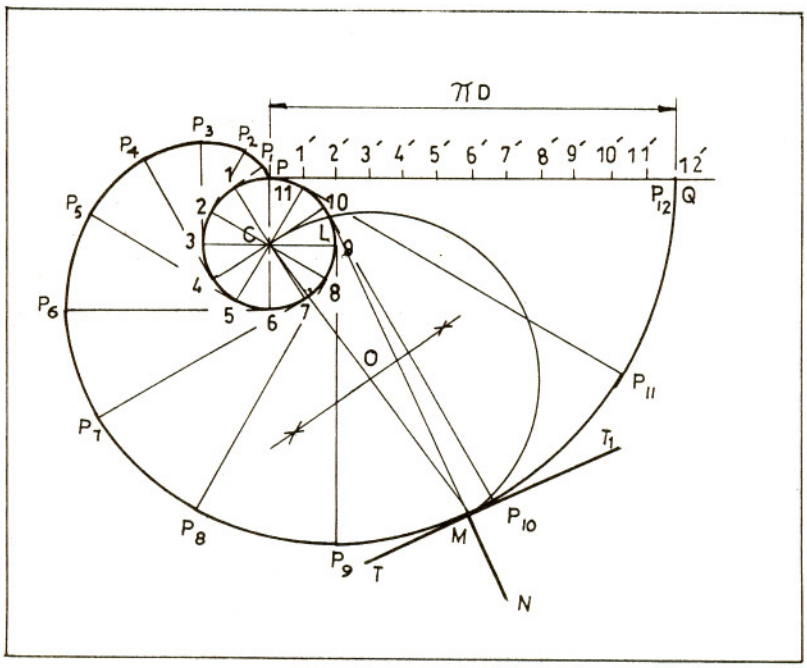
(vi) Now to draw the tangent and normal to the involute at any point M on it, join M with center C of the circle. With that line as a diameter draw a semi circle cutting the circle in point L. Join L with M to get normal and draw right angle to this normal at point M to get tangent $TT_1$.




Q6




Q7




Q 8

SUBJECT: ENGINEERING GRAPHICS / ENGINEERING DRAWING (DEC

A-02/C-02 TIME: 4 HOURS MAX MARKS 100

NOTE:

1. This question paper has eight questions. These are grouped into 4 sections ie., A,B,C and D.
2. Sections A and B are compulsory and contain one question each.
3. Question 1 of section A is to be answered on the question paper itself. Detach first sheet (Pages 1& 2) and attach it to main drawing sheet.
4. All other questions of sections B,C and D are to be answered on the drawing sheet
5. Retain all construction lines. All lines should be sharp and clearly visible. Construction lines, normal lines and section lines should be of distinct thickness/intensity.
6. All dimensions are in mm. Any missing dimension/ information may be suitably assumed if necessary and stated.

## SECTION A (COMPULSARY)

NOTE ; Answer this on question paper itself and annex with the drawing sheet.

Q1.A Fill in the blanks with suitable word/words: (2×5=10)

| | QUESTIONS | ANSWER HERE |
|---|---|---|
| (i) | The size of A3 standard drawing sheet is | 297 × 420 mm |
| (ii) | The process of showing the cut surface of an Object in a sectional view is called | Cross hatching |
| (iii) | The function of a _____ is to prevent the relative movement between them. | Key |
| (iv) | The sum of focal distances of any point on an ellipse in 120mm, then the length of major axis will be. | 120 mm |
| (v) | The axial height of the tetrahedron is _____ where "s" is the side of the tetrahedron. | $s\frac{\sqrt{2}}{\sqrt{3}}$ |

B Choose the correct answer: (2 × 4 = 8)

(i) When a point contained by H.P. and lies in front of the V.P. then its :-

(a) Plan lies in XY
(b) Elevation lies in XY
(c) None of the projections lie in XY
(d) Both plan and elevation lie in XY Elevation lies in XY

(ii) When a line is parallel to V.P. and inclined to the H.P. it has its:
(a) H.T. (b) V.T.
(c) Both H.T. and V.T. (d) No trace H.T.

(iii) If D is the diameter of sphere, in isometric projection its value will be equal to:
(a) $\frac{\sqrt{3}}{\sqrt{2}}D$ (b) $\frac{\sqrt{2}}{\sqrt{3}}D$
(c) 0.82 $D$ (d) $D$ $D$

(iv) Four equal spheres are resting in such a manner that each sphere is touching the other three. A solid can be imagined if the four centers are joined by straight lines, The solid is:

(a) Triangular pyramid (b) Square pyramid
(c) Cone (d) Tetrahedron Tetrahedron

SECTION B (COMPULSARY)- Marks – 40

Q2 Figure 1 (on page 4) shows the pictorial view of a CASTING. Draw its following views in scale full size:
(i) Sectional front view at A-A
(ii) Left side view
(iii) Top view
Note – (i) Give all dimensions.
(v) Projection symbol
(vi) Print title, CASTING (18+10+7+1+1=40)

SECTION C (Marks – 2 × 14 = 28)
Attempt any two questions from this section

Q3 The top view of a 80 mm long line AB measures 55 mm while length of its front view is 70 mm .its one end A is in the H.P. while the other end is in the V.P. Draw its projections and also find out its inclination both with H.P. and V.P.

Q4 A square pyramid of 40 mm base side, axis 56 mm long is freely suspended by a string from one of its corners of base. Draw the projections of a solid.

Q5 A pentagonal pyramid base side 30 mm and axial height 60 mm lies on one of its triangular faces in the H.P. and its axis parallel to the V.P. it is cut by a section plane normal to the H.P. and 30 to the V.P. in the middle of the axis draw the top view, sectional front view and true shape of the section when the apex is removed.

Q 6 A frustum of a square pyramid (base edge 45 mm, top edge 25 mm and axial height 40 mm) is placed on its larger face in the H.P. a sphere of 30 mm diameter is placed centrally on its top face. Draw the isometric scale and isometric projection of the combined solids.

SECTION D (Marks – 1 × 14)
Attempt any one question from this section

Q 7 Draw sectional front view and top view of a double riveted lap joint (chain riveting) suitable for 9 mm plate thickness. Give proportionate dimensions in terms of rivet diameter (d).

Q 8 A point 'P' is 30 mm and 40 mm respectively from two straight lines, which are at right angles to each other. Draw a rectangular hyperbola passing through the point 'P' with in 10 mm distance from each line.

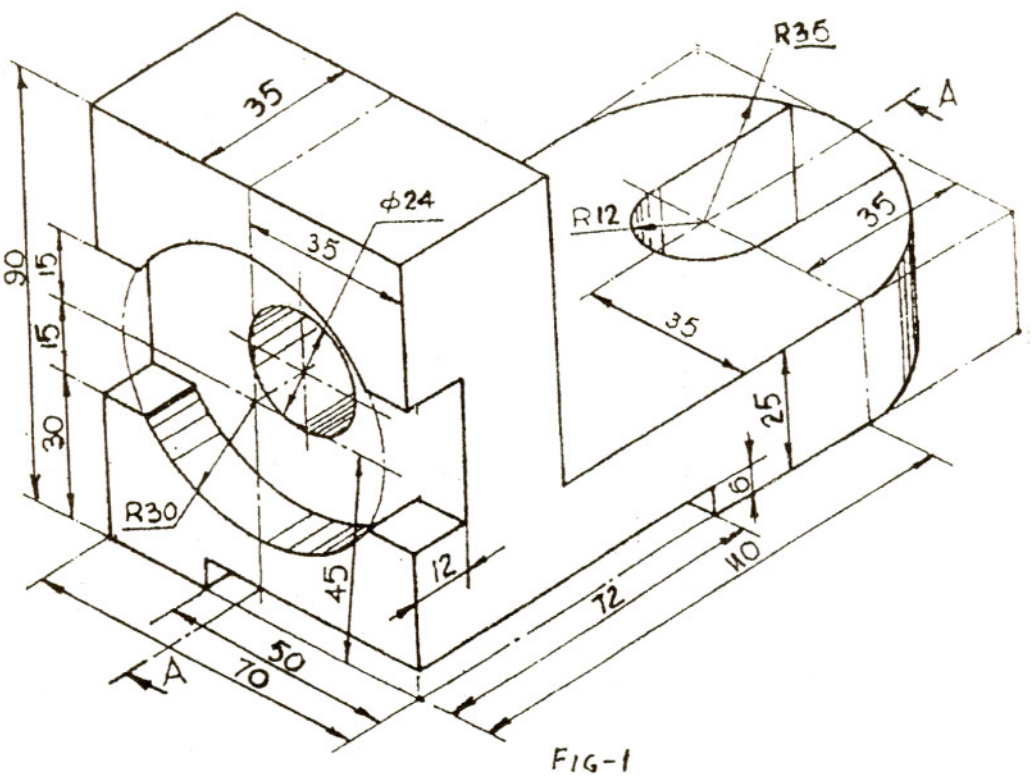



FIG-1

Q3

(i) Assume the line contained by V.P and the end A in H.P.In this position its p will appear along xy line. Therefore take $a_1^1 - b$ along $xy$ line measuring 55mm(given length in top view). Through $b$ erect a vertical projector $b$M. With $a_1^1$ as center and radius 80 mm (true length) strike an arc on $b$M to locate $b^1$ on this projector. Join $a_1^1$ with $b^1$.

(ii) Measure the angle $\theta$, the inclination of the line with H.P.Revolve the line keeping contact angle $\theta$ with H.P through the end B.The locus of end $a_1^1$ will be an arc, which will appear as a straight line along $xy$ line, and arc in top view. So with $b$ as center, draw an arc equals 55mm.With $b^1$ as the center and radius 70mm(equals given length in elevation). draw an arc to locate $a^1$ in $xy$.Join $a^1$ with $b^1$ the required elevation. Through $a^1$ draw a vertical projector and locate point $a$ on the arc. Join $a$, with $b$, the required top view.
Through $a$ draw the locus line $rs$ parallel to $xy$. With $b$ as center and radius TL (80mm) draw an arc to locate point $a_1$ on locus line $rs$. Join $b$ with $a_1$ and measure the angle $\phi$, the inclination of line with V.P.

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Q.4

(i) Assume the square pyramid to be resting on its base in the H.P with the base edges equally inclined to the V.P. Draw the projections in this position (E-1) is the elevation and (P-1) the plan.

(ii) Assume the pyramid to be hung from corner C. Locate point g (Center of the gravity of pyramid) at $\frac{1}{4}th$ of the axial height from base. Join $C^1$ with g and extend to point $l$ on $a^1o^1$. In the hanging position this line $c^1l$ will be vertical.

(iii) Redraw the elevation keeping $c^1l$ in the vertical position as shown in elevation (E-2).

(iv) Complete plan (P-2) by drawing vertical projectors from (E-2) and horizontals from plan (P-1), as shown in figure.

---

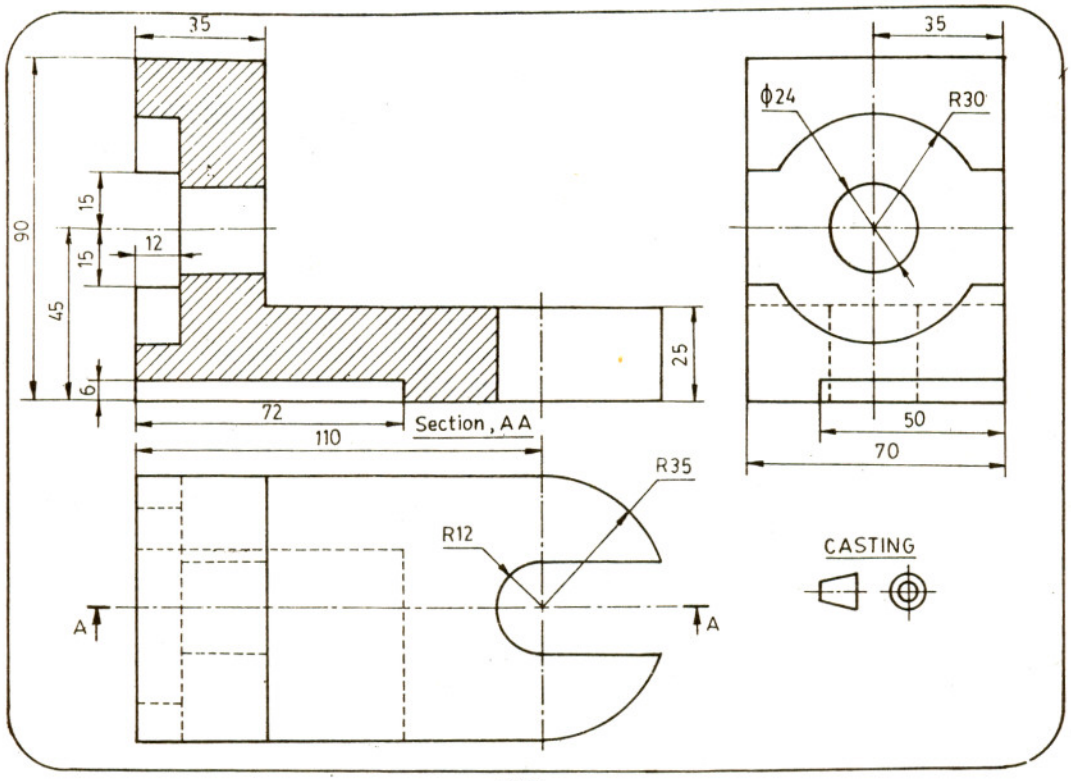
Q.5

(i) Assume the pyramid to be resting on its base with one base edge perpendicular to the V.P. Draw the projections in this position, (E-1) is the elevation and (P-1) the plan. In this position, the triangular face OAB will be seen as a straight line $(O - a^1b^1)$ in elevation.

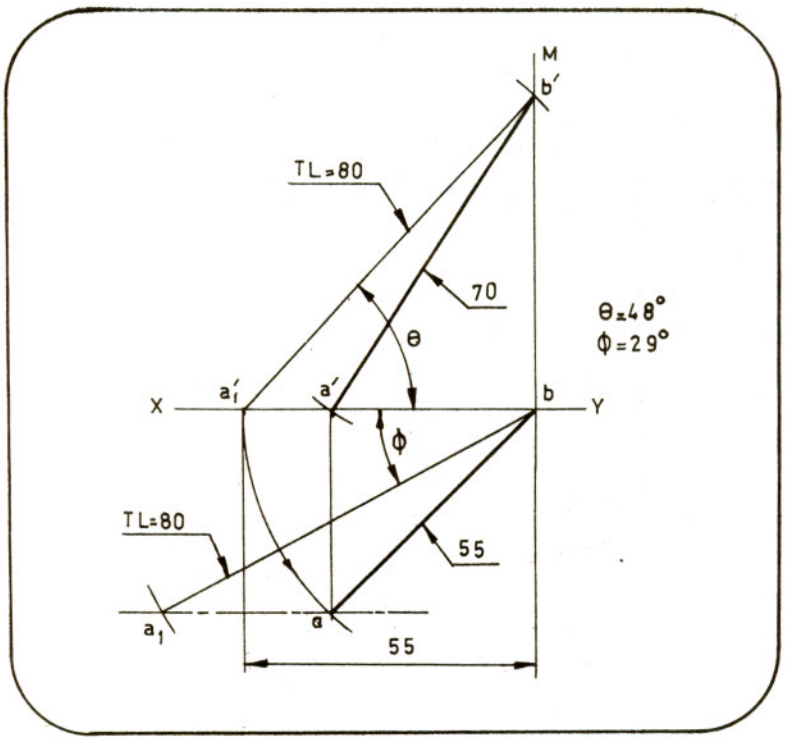
(ii) Redraw the elevation (E-1) to elevation (E-2) keeping $O - a^1b^1$ in xy.

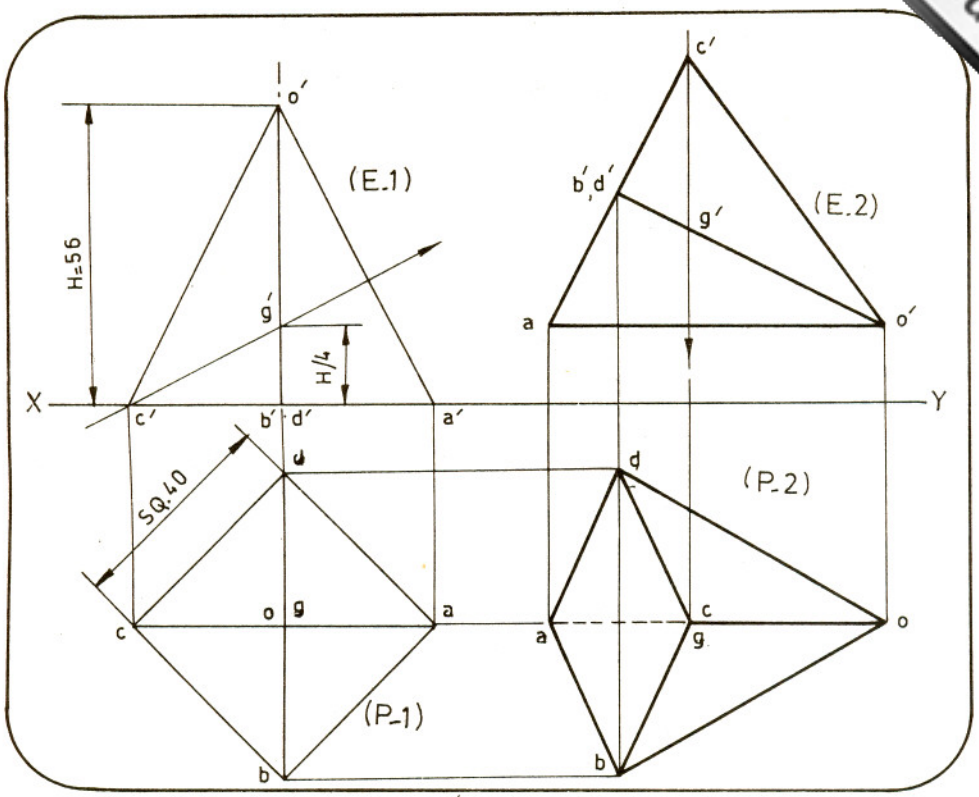
(iii) Project (P-2) by drawing vertical projections from (E-2) and horizontals from (P-1) as shown in (E-2).

(iv) Locate the middle point $g^1$ of the axis in (E-2) and project to point g in top view along the axis. The cutting plane H.T will be seen as a line in top view at $30^0$ to

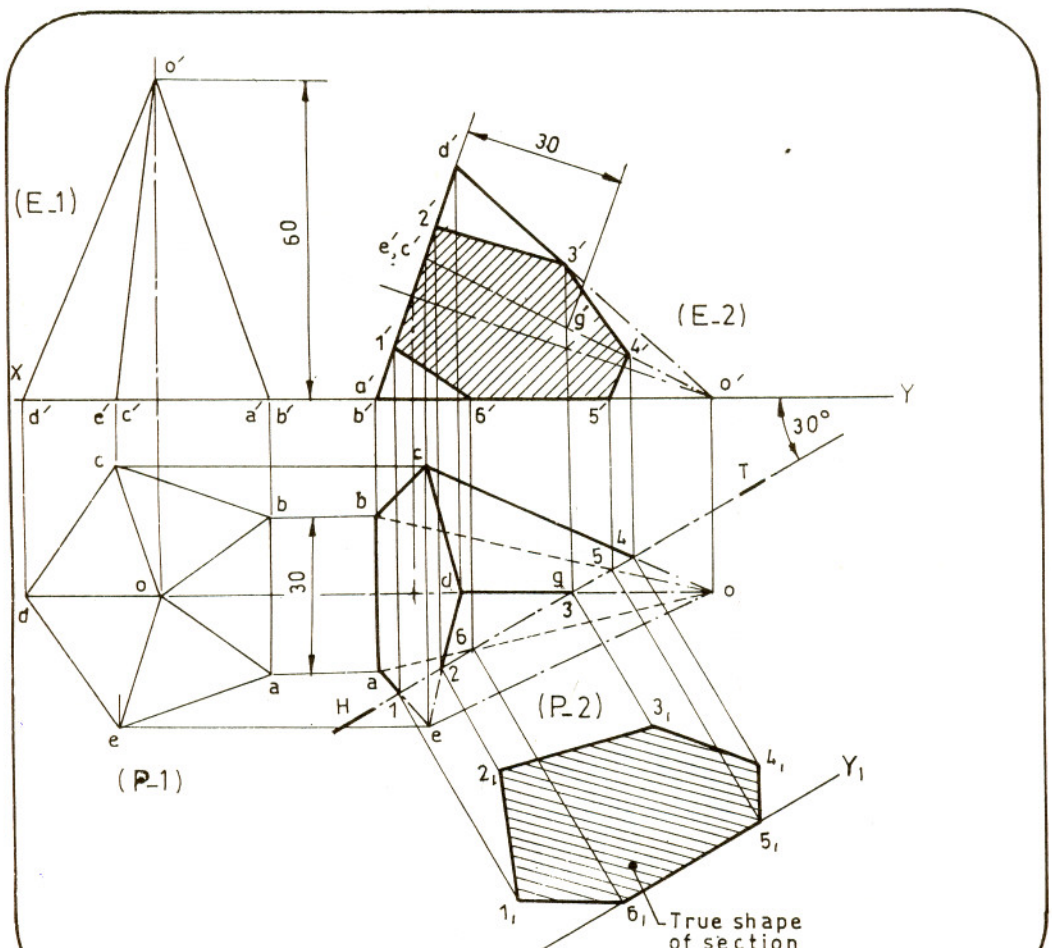



Q2






Q4



*xy*. Through g draw the H.T at $30^0$ to xy, and mark the points of intersecti
edges and the H.T.

(v) For sectional elevation project the points of intersection to the corresponding edges as $1^1 - 2^1 - 3^1 - 4^1 - 5^1$ and $6^1$. Join these points and show the section lines in this area.

(vi) For true shape of section take $X_1Y_1$ parallel to H.T. Project the points1,2,3.....etc on $X_1Y_1$.Mark the heights of each point from $X_1Y_1$ equal to the heights of points $1^1,2^1,3^1$....*etc* from the elevation from XY. Join the points and show the hatching lines in this area.

---

Q.6

(i) Draw the top view of the frustum as a helping figure and the isometric scale.

(ii) For isometric projection of frustum take a vertical line OP equal 40mm in isometric scale. At O and P construct both the bigger and smaller square faces with isometric lengths as shown. Join the corresponding edges.

(iii) Take PQ equal to 15mm in isometric scale on OP extended. Through Q draw a circle of 15mm actual radius giving the isometric projection of the sphere.

(iv) Don't show the hidden features, as they are not required in isometric projection.

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Q.8 (i) Draw lines OA and OB at right angles to each other, mark the position of the point P, 40mm from OA and 30mm from OB.

(ii) Through P, draw lines CD and EF parallel to OB and OA respectively

(iii) Along PD mark a number of Points 1,2,3.etc not necessarily at equal distances. join O1,O2,etc cutting PT at points $1^1,2^1$ etc. Through point 1 draw a line parallel to OA,and through$1^1$ line parallel to OB intersecting each other at a point $P_1$. Obtain point $P_2$ in the same manner. Take a point $3^1$ at 10mm distance along PD locate point 3 along PD. join O with $3^1$.Obtain a point $P_3$ in the similar manner.

(iv) For locating the point say $P_6$ to the left of P take $C - 6^1$ 10mm along CP .Join O with $6^1$ and extend to locate point 6 along PE. Through $6^1$and 6 draw lines parallel to OA and OB respectively to locate $P_6$ .Similarly obtain other points $P_4, P_5$, etc. Draw thc hypcrbola through points $P_6, P_5, P_4, P, P_1, P_2$ and $P_3$ .ctc.