BYS

Given and solution must be dark

2B - dark 4H - Light	75° inclined	6mm 4mm

Engineering drawing

1. Freehand Technical lettering.

(a) Alwz use 2B pencil.
(b) Alwz use capital letter.
(c) If possible, use straight line.
(d) Alwz use horizontal guidelines (4H).
(e) All letters inside 'Title Box' = 6mm high.
(f) All letters inside 'Working space' = 4mm high.
(g) Space between two ~~letters~~ words = Height of letter
(h) " " two sentences = 2 x height of letter.
(i) " " two paragraphs = 4 x height of letter.
(j) Vertical space between two sentences = height of letter.

For letters, height > letter

7:5, 7:6, 6:5

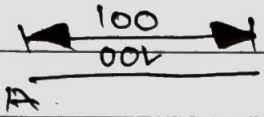
ABCDEFGHIJKLMNOPQRSTUV
WXYZ

0123'456789

Dimensioning :-

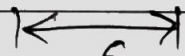
1. Dimensioning of straight lines
2. Dimensioning of circles
3. Dimensioning of angles.

* Extension line (4H pencil)
  - 1cm length
  - Perpendicular to object line
  - Drawn from ends of line.
  - 2 to 3 mm away from ends.

* 

3:1 ratio arrow head

Dimension line थोड़ा मोटा मत लेना



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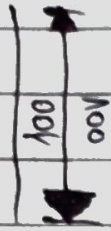
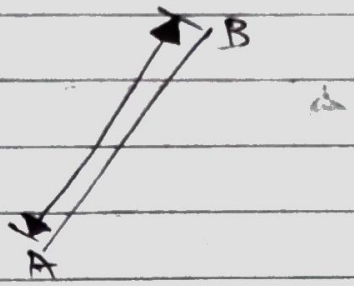
(All dimensions are in mm)

* Dimension line (4H pencil)
  - parallel to object line
  - Drawn from the midpoints of extension line

* Arrowhead (2B pencil)

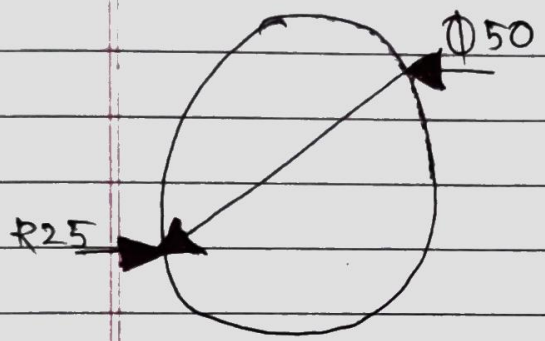


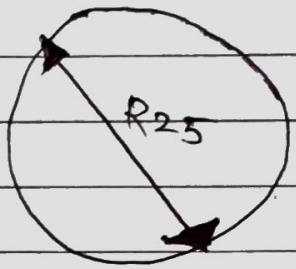


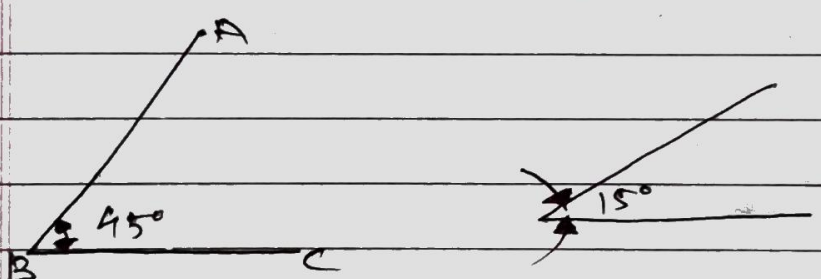
Dimensioning of circle.

Φ = diameter

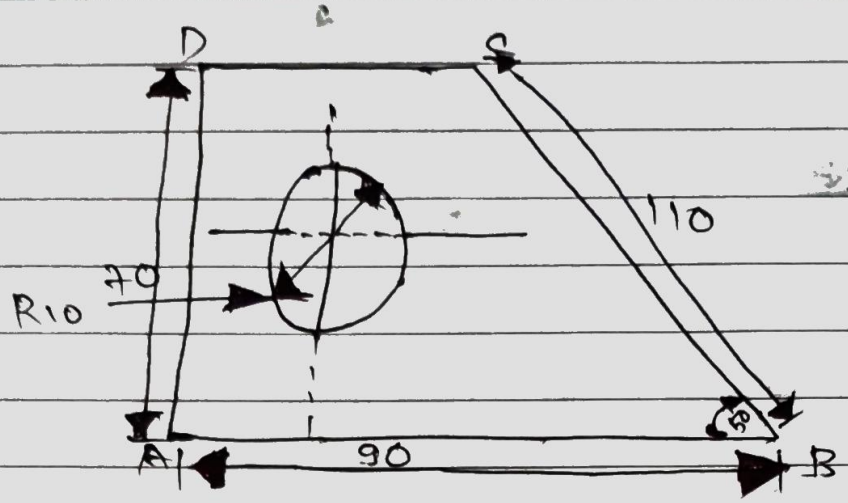
R = radius





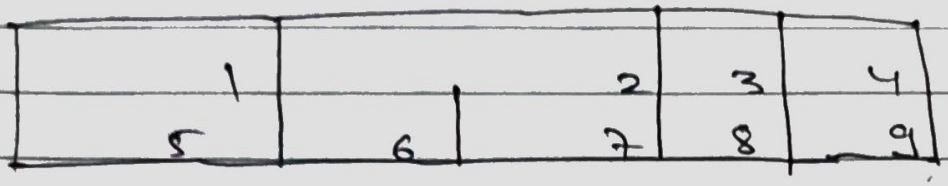


1 inch = 25.4 mm
1 cm = 10 mm



H/W :- Construct a regular heptagon inscribed in a circle of diameter 60 mm.

:- Construct a regular heptagon of sides 35 mm



1) NCIT, BALKUMARI LALITPUR
2) DRAWN BY:- YOUR NAME
3) SCALE :- 1:1
4) SHEET NO:- 01
5) GEOMETRICAL CONSTRUCTION
6) PROGRAM :- BESE(MIB)
7) ROLL NO :- ~~2079/11/10~~ 221627
8) DATE :- 2079/11/10
9) CHECKED BY :-

Chapter - 2 Applied Geometry

2.1 :- Geometrical construction.

(1) Trisect hundred mm long straight line.

(2) Divide 100 mm straight long line into 6 equal parts.

(3) Divide 100 mm long straight line in to 2:3:4 ratio

(4) Trisect an acute angle

(5) Trisect an obtuse angle

(6) Construct a regular pentagon inscribed in a circle of diameter 70 mm.

(2) Construct a regular pentagon of sides 40 mm

For (1)

* Draw a horizontal line AB equals to 100mm
* From end A and B, draw 30° inclined lines
* Draw a 60° inclined lines from point C, we get 1 and 2 (solution)

For (2)

* Draw a horizontal line AB equals to 100mm
* Draw a reference line from end A (any length, any inclination), Taking arc. length = 10mm, mark 6 points on the reference line.
* Join the last point (6) to the another end (B).
* Draw parallel lines from all points on the reference line to the given line AB, we get 1', 2', ----- 5', 6' (solution)

For (3)

* All steps are similar to question no. (2) but the reference line should be divided into 9 equal parts (Given ratio)

For (4)

* Draw a given angle ABC, Mark point D on BA, length (30mm), then draw horizontal lines and vertical lines from D
* Draw a line BG in such a way that FG = 2×BD.
* Bisect angle ABG. Join BH (solution)

For (5)

* Draw an obtuse angle ABC, centre at B radius (=30mm), draw an arc DE Join DE,
* Find the midpoint of DE (F), centre at F, radius = FD or FE, Draw a semicircle DE
* Radius = FD, mark points G and H on the semicircle.
* Join GB and HB (solution)

for (6)

* Draw a circle of diameter 70mm.
* Draw a horizontal line AB from the centre of the circle then divide it into five equal parts
* Centre at A, radius = AB, draw an arc B1
* Centre at B, radius = BA, draw an arc A1
* Join 1 and 2 then extend it to the circumference of circle, we get C
* Arc length = AC, Mark points D, E and F on the circumference of the circle and Join them (solution)

for (7)

* Draw a horizontal line, AB = 40mm,
* Bisect AB then draw the bisector
* Draw a perpendicular line from B
* Centre at B, radius = BA, draw an arc. AC and Join AC
* We get 4 and 6
* Find the midpoint of 6, 4 i.e. 5.
* Centre at 5 and radius = 5-A or 5-B. Draw a circle.
* Arc length = AC, Mark points D, E and F on the circle, Join them (solution)

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common tangents

Q.N 1. Construct an external / direct / uncrossed common tangents between two circles of diameter 30mm 60mm where center to center distance is 70mm.

(2) Construct an internal / indirect / crossed common tangents between two circles of diameter 30mm and 60 mm where center to center distance is 70mm.

conic section

Q.N (1) Construct an ellipse by using 'four center method', where major axis is 80mm and minor axis is 50mm.

(2) Construct a parabola where base of parabola is 70 mm and axial height is 60 mm (use tangent / triangular method)

(3) Construct a hyperbola where the distance of focus from directrix is 25mm and eccentricity is $3/2$.

Tangent

Q.1 and 2

(1) Draw a horizontal line AB = 70mm (center to center distance).

(2) Draw two circles of diameter 30mm and 60mm at center A and B.

(3) find the midpoint of A and B (C). Center at C, radius = CB, draw a reference arc

(4) Center at B, radius = $R_2 - R_1 = 15mm$, draw a reference circle for external common tangent and radius = $R_2 + R_1 = 45mm$, for internal common tangent.

(5) Join BD and BE then extend it to the circumference of circle, we get F and G.

(6) Draw BF ∥ AH
BG ∥ AI

(7) Join H-F and I-G i.e. (solution)

Conic section

The section obtained after cutting a right circular cone, by a cutting plane into different positions, relatives to the axis is called conic section.

Types:-

(i) Isosceles triangle - If the cutting plane is ll to the axis.

(ii) Circle - If the cutting plane is perpendicular to the axis.

(iii) Ellipse - If the cutting plane is inclined to the axis and cuts all the generators.

(iv) Parabola - If the cutting plane is inclined to the axis but parallel to any one of the generators.

(v) Hyperbola - If the cutting plane is inclined to the axis and cuts a double cone.

In other words, the conic may be defined as the locus of point, moving in a plane in a such a way that the ratio of its distance from a fixed point (Focus F) and a fixed straight line (directrix AB) is always constant.

$$\text{eccentricity (e)} = \frac{\text{distance of focus}}{\text{distance from directrix}}$$

(i) $e < 1$, ellipse

(ii) $e = 1$, parabola

(iii) $e > 1$, hyperbola

Note

7 The line passes through the focus and perpendicular to the directrix is called axis.

> The locus of point which lies on the axis is called vertex (V)

Perpendicular

Orthographic projection :-

- Projection lines are parallel to each other and perpendicular to picture plane

Steps :-

(1) Identify the front face.

a) The face indicated by arrow head, must be front face.

b) If there is no arrow head, the longest face should be front face

c) If both faces are equal, the face having more informations should be front face.

(2) Calculate the required area, then draw a rectangle.

(i) Height of F.V. = Height of S.V.

(ii) length of F.V. = length of T.V.

(iii) Height of T.V = length of S.V.

(3) Draw X and Y axis, then 4 reference lines (1cm apart)

(4) Draw rectangle FOR F.V. ; T.V. and S.V.

F.V = 1 and H

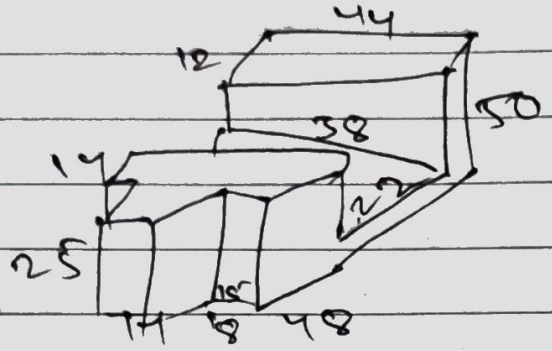
T.V = 1 and B

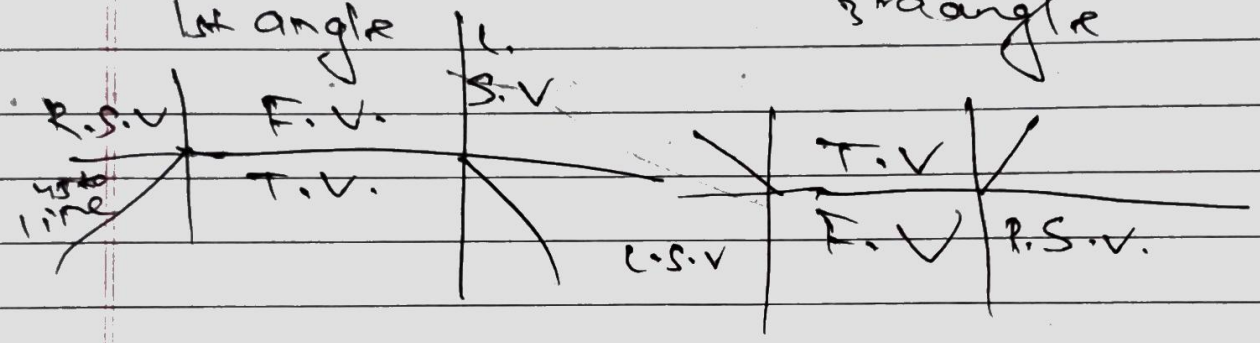
S.V - B and H

(5) Draw F.V., then draw horizontal and vertical lines from all corners to S.V and T.V.

(6) Draw T.V, then draw horizontal lines from all corners to S.V

(7) Draw S.V.





For Hyperbola

* Draw a vertical line AB (directrix any height)
* From a midpoint of AB (O), Draw a horizontal line OX. Mark point F on OX where OF = 25mm
* Mark vertex V according to given eccentricity.
* Draw a vertical line from V.
* Center at V, radius = VF Draw an arc CD.
* Join OC and OD then extend them.
* Mark number of points on OX
* then draw vertical lines from them
* Taking arc length = perpendicular height of 1, 2, 3, 4 from OX; mark points P_1, P_1', P_2P_2', P_3P_3' from centre F
* Join them using french curve.

For ellipse

* Draw a horizontal line AB = 80mm (major axis)
* Bisect AB, then mark C and D where, OC and OD = 25, 25 mm (Minor axis)
* Extend OC to E in such a way that OA = OE

* Join A C
* Center C, Radius = CE, Draw an arc EF.
* Bisect FA and draw the bisector, we get, C_1 and C_2
* Mark C_3 and C_4 in such a way that $OC_1 = OC_3$ and $OC_2 = OC_4$
* Join all centers
* centre at C_1, Radius = C_1A, draw an arc P_1, P_2
* centre at C_3, Radius = C_3B, draw an P_3 P_4
* centre at C_2, radius = C_2C_1 draw an arc P_1 P_3
* centre at C_4, Radius = C_4D, draw an arc P_2 P_4

For Parabola

* Draw a horizontal line AB = 70mm (base of parabola)
* Bisect AB, then draw the bisector and mark points C and D, where OC = height of parabola and CD = 60mm also

* Join AD and BD, then divide BD and AD into 8 equal parts
* Join 1-1, 2-2, 3-3, ------ 7-7
* Then mark points $P_1, P_2, P_3, P_3', P_2'$ and P_1'
* Join $A, P_1, P_2, P_3, C, P_3', P_2', P_1'$ and B

Curves and Helix

* Cycloid :- These curves is generated by a fixed point on the circumference rolling or generating circle, which rolls without slipping along a straight line (directing line).

Questions

(1) Construct a cycloid of a circle of diameter 40 mm

* Involutes :- This curve is generated by an one end of piece of thread unwound from the perimeter or circumference of the object by keeping another end fixed.

(1) Draw an involutes of a regular pentagon of sides 15mm

(2) Draw an involutes of a circle of diameter 30mm.

Centre	Radius	Arc
1	1-0	$0P_1$
2	2-P_1	P_1P_2
3	3-P_2	P_2P_3
4	4-P_3	P_3P_4
0	0-P_4	P_4P_0

Archemedian's spiral

This curve is generated by a point, moving in a circle in such a way that, its movement towards or away from the pole is uniform with the increase of vectorial angle from a straight line.

Helix

This curve is generated by a point, moving around the surface of right circular cylinder or cone, in such a way that its axial advance is uniform with its movement around the surface of cylinder or cone.

(cylinder and cone)

* Draw views of given object

*) Divide the circle into 8 parts
*) Mark points 0', 1'7', 2'6', 3'5', 4' on the base of front view
*) Divide the ht. of front (Rest the) view into 8 equal parts
*) Then draw horizontal lines from these points we get, $P_0, P_1 --- P_7, P_8$
*) Join all these points
*) For conical helix draw vertical lines from $P_0, P_1 --- P_7, P_8$ to top view we get $P_0, P_1 --- P_7, P_8$. Then join them (for P_2 and P_6 take horizontal distance of these points to right edge, mark P_2 and P_6 from center of circle.

(Archimedes spiral)

1) Draw a circle of given radius = 40mm
2) Divide the circle in 8 equal parts.
3) Divide O, P_0, line into 8 equal parts.
4) Centre at P_0, radius = $P_01, P_02 --- P_07$, draw arcs $1P_1, 2P_2, 3P_3 --- 7P_7$
5) Join $P_0, P_1 --- P_70$.

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Cycloid

1) Draw a circle of given diameter (40mm)
2) Then divide it into 8 equal parts.
3) Draw horizontal lines from all points on the circumference of circle (any length).
4) Mark 1, 2, 3, ---7, 0 on the base line where length of all divisions = small division of circle.
5) Draw vertical lines from 1, 2, 3, ---7, 0, we get $C_1, C_2, C_3 --- C_0$
6) Taking arc length = radius of circle (20mm) mark points $P_1, P_2, --- P_7 P_0$ on the line drawn from the circumference of circle.
7) Join all these points.

Involutes (pentagon)

1) Draw a regular pentagon of given sides (15 mm).
2) Extend all sides of pentagon into anti-clockwise direction.
3) Follow the given table.

Center	Radius	Arc
1	1-0	$0P_1$
2	2-P_1	P_1P_2
3	3-P_2	P_2P_3
4	4-P_3	P_3P_4
0	0-P_4	P_4P_0

Involutes (circle)

1) Draw a circle of given diameter (30mm)
2) Divide the circle into 8 parts (equal)
3) Draw tangents from all points into anti-clockwise direction on circle.

Follow the given table;

Center	Radius	Arc
1	1 - 0	$0P_1$
2	2 - P_1	P_1P_2
3	3 - P_2	P_2P_3
4	4 - P_3	P_3P_4
5	5 - P_4	P_4P_5
6	6 - P_5	P_5P_6
7	7 - P_6	P_6P_7
0	P_7	P_7P_0

Surface Development

Development of prisms:-

(1) Re-draw the given views
   a) Mark 1,2,3 --- on the top view
   b) " 1',2',3' --- on the base of F.V
   c) Mark p',q',r'-- on the F.V

(2) Draw sectional T.V.
   a) Draw horizontal line from centre of TV
   b) Draw vertical lines from p',q',r' ---to T.V you get p,q,r-then join them and draw hatching lines inside it.

(3) Draw 'True shape' of section
   a) Draw a line parallel to cutting plane like and perpendicular lines from p',q',r'---
   b) Mark p,q,r according to sectional T.V. then join them and draw hatching lines inside it.

(4) Draw surface development
   a) Draw horizontal lines from base and top of F.V
   b) Mark 1,2,3 --- on the base line according to side length of T.V.
   c) Draw vertical lines from 1,2,3 ---- and horizontal lines from p',q'r'---you get p,q,r-then join them.

(d) Draw bottom cover

(e) Draw top cover