

## Exercise 3 – 25 Marks

### Instructions:

- All AutoCAD drawings should be made within 420 x 297 mm rectangle - A3 Sheet size.
  - Solution should be complete & all dimensions should be made. No marks for incomplete drawings.
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- 3.1. Construct an ellipse, with distance of the focus from the directrix as 50 and the eccentricity is  $\frac{2}{3}$ . Also, draw a tangent and normal to the curve at a point 40 from the directrix. (7 Marks)
- 3.2. Draw an epi-cycloid of a circle of 400 diameter, which rolls outside on another circle of 1200 diameter for one revolution clock-wise. Draw a tangent and a normal to it at a point 900 from the center of the direction circle. (10 Marks)
- 3.3. A disc in the form of a square of 35 mm side is surmounted by semi-circles on the two opposite sides. Draw the path of the end of the string, unwounded from the circumference of the disc. (8 Marks)

### Note:

- Considering the time constraint, only 3 questions are given above as the exercise problem. Students are advised to do self practice with reference to the textbook problems on the construction of other plane curves – Parabola, Hyperbola, Trochoids, Involute and Helix. Sample problems are given below for reference:

- P3.1. Construct a parabola with base 75 and length of the axis 42. Draw a tangent to the curve at a point 23 from the base. Also, locate the focus and directrix to the parabola.
- P3.2. Draw a hyperbola with half the major axis as 50, the abscissa 70 and double ordinate 160.
- P3.4. Draw the involute of a circle of 40 diameter. Also, draw a tangent and normal to the curve at a point 95 from the center of the circle.
- P3.5. Draw a helix of pitch equal to 45, upon a cylinder of diameter 40 and height 90. Develop the surface of the cylinder along with the helix. Assume the starting point P to be on the left extreme horizontal center line in the top view.

### Exercise 3 – Sample Problems

- P3.6 A circle of 50 mm diameter rolls on a horizontal line for half revolution clockwise and then on a line inclined at  $60^\circ$  to the horizontal for another half revolution clockwise. Draw the curve traced by a point P on the circumference of the circle, taking the top most point of the rolling circle as the position of the generating point.
- P3.7 ABC is an equilateral triangle of side 70 mm. Trace the loci of vertices A, B and C, when the circle circum-scribing ABC, rolls without slipping, along a fixed straight line for one complete revolution.
- P3.8 An iron rod of length 30 mm is welded at the center of a wheel having a diameter of 50 mm. If the wheel makes one and half revolution without slipping on the straight edge of a table, draw the path traced by the tip (free-end) of the iron rod.
- P3.9 A straight rod 110 long rolls on a semi-circle of diameter 80 without slipping. Obtain the curve traced by the end points of the line.
- P3.10 A wheel of 50 mm diameter rolls downward on a vertical wall for a half revolution and then on the horizontal floor for the remaining half revolution. Draw the locus of a point A on the circumference of the wheel, the initial position of which is the contact point with the wall..
- P3.11 A stone is thrown from a building of 7 m height and at its highest point of flight, the stone just crosses a palm tree of 14 m height. Trace the path of the stone, if the distance between the building and the tree is 3.5 m. At what distance (from the building) the stone reach the ground.
- P3.12 The headlight reflector of a four-wheeler has a maximum rim diameter of 115 mm and a maximum depth of 90 mm. Draw the shape of the reflector. Draw a tangent and normal at any point on the curve.
- P3.13 Draw an ellipse by oblong method when the major and minor axes are 120 and 80 respectively.