2. Divide the circle into any number of equal even parts (say six). Project these points horizontally on the vertical centre line of the circle. These points are shown by a' and b' in Figure (*a*).

3. Divide the angular displacement of the cam during outstroke into the same number of equal even parts as the circle is divided. Draw vertical lines through these points.

4. Join *AB* which intersects the vertical line through 3′ at *c*. From a' draw a line parallel to *AB* intersecting the vertical lines through 1′ and 2′ at *a* and *b* respectively.

5. Similarly, from b' draw a line parallel to *AB* intersecting the vertical lines through 4′ and 5′ at *d* and *e* respectively.

6. Join the points *A a b c d e B* by a smooth curve. This is the required cycloidal curve for the follower during outstroke.

Let θ = Angle through which the cam rotates in time t seconds, and ω = Angular velocity of the cam.

We know that displacement of the follower after time t seconds,

$$x = S\left[\frac{\theta}{\theta_O} - \frac{1}{2\pi}\sin\left(\frac{2\pi\theta}{\theta_O}\right)\right] \quad \ldots \textbf{(i)}$$

∴ Velocity of the follower after time t seconds,

. . . [Differentiating equation ***(i)****]*

$$\frac{dx}{dt} = S\left[\frac{1}{\theta_O} \times \frac{d\theta}{dt} - \frac{2\pi}{2\pi\theta_O}\cos\left(\frac{2\pi\theta}{\theta_O}\right)\frac{d\theta}{dt}\right] \quad \ldots \textbf{(ii)}$$

<u>Construction of Cam Profile for a Radial Cam</u>

Example 1. *A cam is to give the following motion to a knife-edged follower:* ***1.*** *Outstroke during 60° of cam rotation;* ***2.*** *Dwell for the next 30° of cam rotation;* ***3.*** *Return stroke during next 60° of cam rotation, and* ***4.*** *Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when* ***(a)*** *the axis of the follower passes through the axis of the cam shaft, and* ***(b)*** *the axis of the follower is offset by 20 mm from the axis of the cam shaft.*

Construction

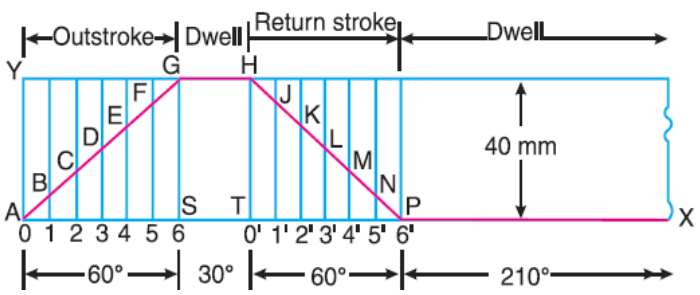

Figure 1

First of all, the displacement diagram, as shown in Figure 1, is drawn as discussed in the following steps:

1. Draw a horizontal line *AX* = 360° to some suitable scale. On this line, mark *AS* = 60° to represent outstroke of the follower, *ST* = 30° to represent dwell, *TP* = 60° to represent return stroke and *PX* = 210° to represent dwell.

2. Draw vertical line *AY* equal to the stroke of the follower (*i.e.* 40 mm) and complete the rectangle as shown in Figure 1.

3. Divide the angular displacement during outstroke and return stroke into any equal number of even parts (say six) and draw vertical lines through each point.

4. Since the follower moves with uniform velocity during outstroke and return stroke, therefore the displacement diagram consists of straight lines. Join *AG* and *HP*.

5. The complete displacement diagram is shown by *AGHPX* in Figure 1.

(a) Profile of the cam when the axis of follower passes through the axis of cam shaft

The profile of the cam when the axis of the follower passes through the axis of the cam shaft, as shown in Figure1, is drawn as discussed in the following steps:

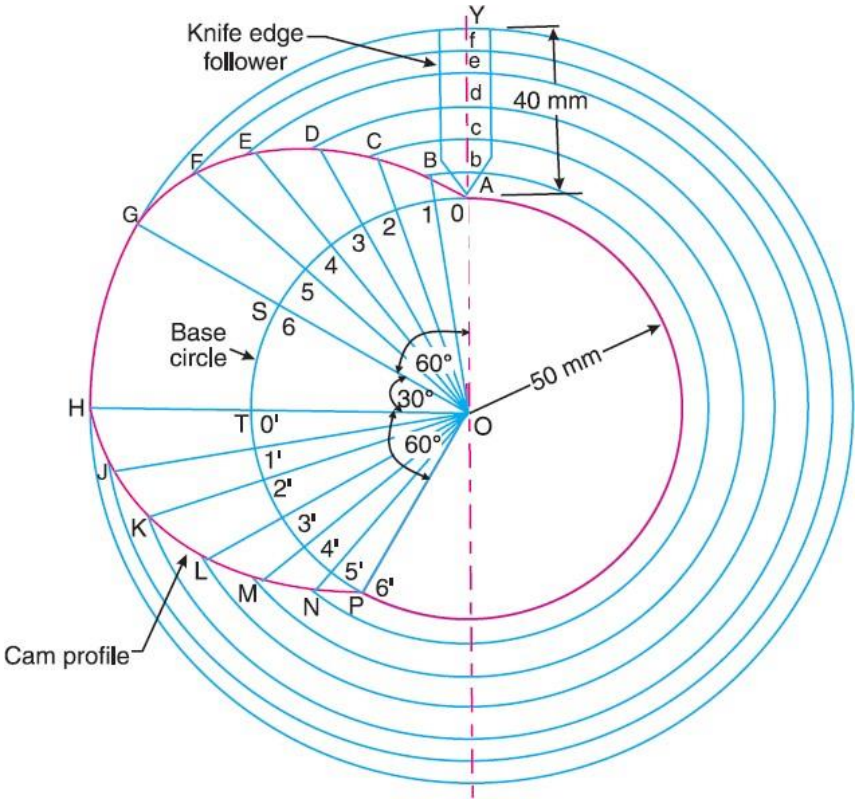

Figure 2

1. Draw a base circle with radius equal to the minimum radius of the cam (*i.e.* 50 mm) with *O* as centre.

2. Since the axis of the follower passes through the axis of the cam shaft, therefore mark trace point *A*, as shown in Figure 2.

3. From *OA*, mark angle *AOS* = 60° to represent outstroke, angle *SOT* = 30° to represent dwell and angle *TOP* = 60° to represent return stroke.

4. Divide the angular displacements during outstroke and return stroke (*i.e.* angle *AOS* and angle *TOP*) into the same number of equal even parts as in displacement diagram.

5. Join the points 1, 2, 3 ...etc. and 0′ ,1′ , 2′ , 3′ , ... etc. with centre *O* and produce beyond the base circle as shown in Fig. 20.11.

6. Now set off 1*B*, 2*C*, 3*D* ... etc. and 0′ *H*,1′ *J* ... etc. from the displacement diagram.

7. Join the points *A*, *B*, *C*... *M*, *N*, *P* with a smooth curve. The curve *AGHPA* is the complete profile of the cam.

(b) Profile of the cam when the axis of the follower is offset by 20 mm from the axis of the cam shaft

The profile of the cam when the axis of the follower is offset from the axis of the cam shaft, as shown in Figure 3, is drawn as discussed in the following steps :

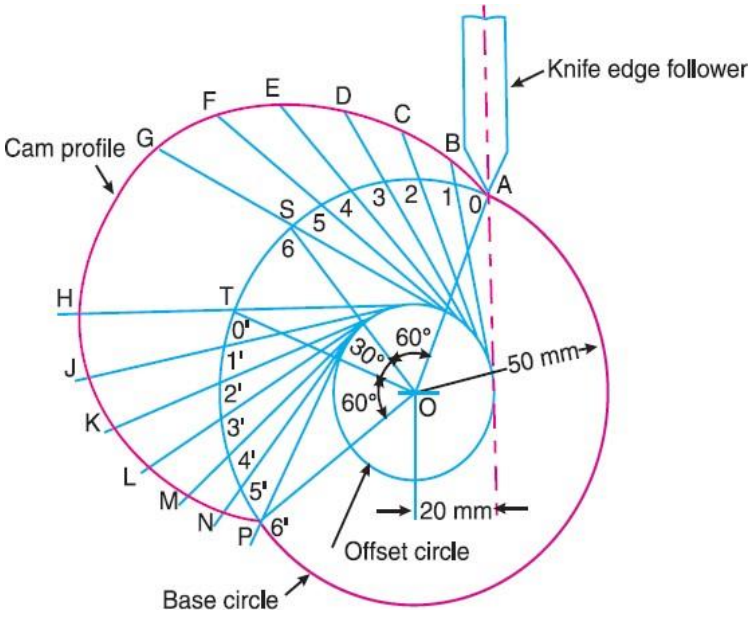

Figure 3

1. Draw a base circle with radius equal to the minimum radius of the cam (*i.e.* 50 mm) with *O* as centre.

2. Draw the axis of the follower at a distance of 20 mm from the axis of the cam, which intersects the base circle at *A*.

3. Join *AO* and draw an offset circle of radius 20 mm with centre *O*.

4. From *OA*, mark angle *AOS* = 60° to represent outstroke, angle *SOT* = 30° to represent dwell and angle *TOP* = 60° to represent return stroke.

5. Divide the angular displacement during outstroke and return stroke (*i.e.* angle *AOS* and angle *TOP*) into the same number of equal even parts as in displacement diagram.

6. Now from the points 1, 2, 3 ... etc. and 0′,1′, 2′,3′ ... etc. on the base circle, draw tangents to the offset circle and produce these tangents beyond the base circle as shown in Figure 3.

7. Now set off 1*B*, 2*C*, 3*D* ... etc. and 0′ *H*,1′ *J* ... etc. from the displacement diagram.