UNIT-3

KINEMATICS OF CAM MECHANISM.

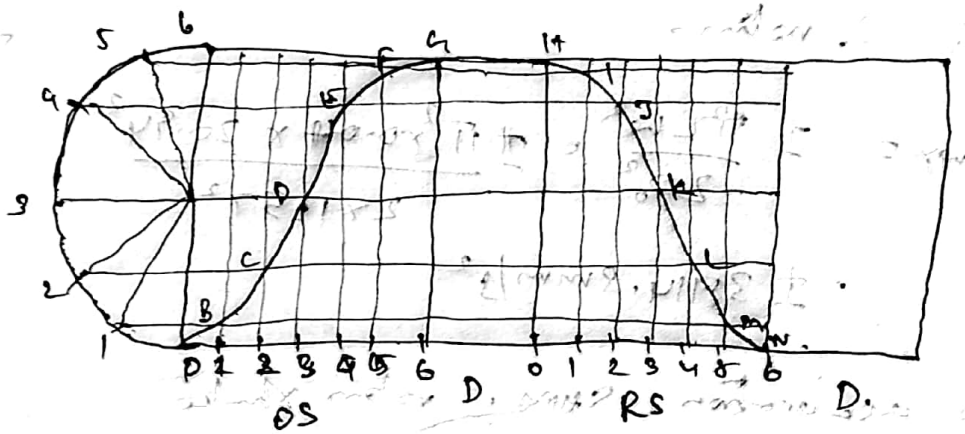
1) A cam is to be designed for a knife-edge follower with following data.

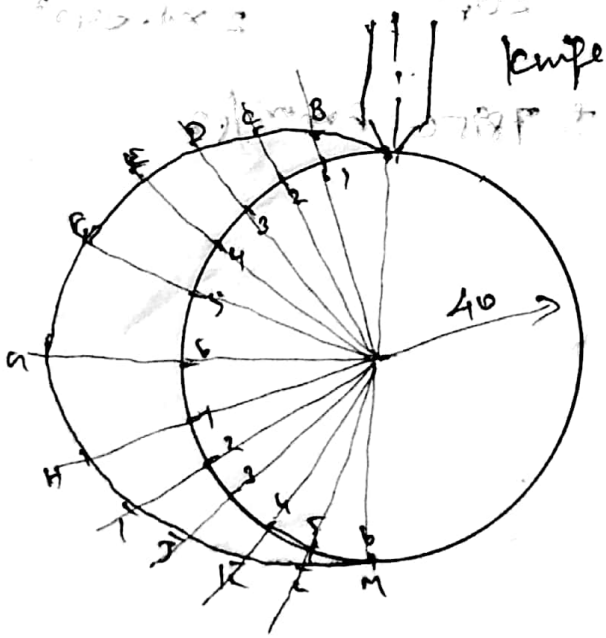
1) follower lift 40mm SHM. 90°.
2) Return SHM. 60°.
3) Dwell for remaining.

Base circle 40mm. axis of the follower is centre of the axis of Cam shaft.

Draw.
1) Displacement diagram 2) Cam profile 3) find max velocity & acceleration. if cam rotates 200rpm.

(AU.M/J-2012, M7-20M)





max velocity of follower during forward & return.

forward SHM. velocity.

$$(V_o)_{max} = \frac{\omega L \pi}{2\theta_o} = \frac{\pi \times 0.04 \times 20.94}{2 \times 1.57} = 0.838 \text{ m/s}$$

return SHM velocity.

$$(V_r)_{max} = -\frac{\pi L \omega}{2\theta_r} = \frac{\pi \times 0.04 \times 20.94}{2 \times 1.047} =$$

$$= -1256.64 \text{ mm/s}.$$

$$= -1.256 \text{ m/s}.$$

max acceleration of follower during forward & return.

$$(a_o)_{max} = \pm \frac{\pi^2 L \omega^2}{2\theta_o^2} = \pm \frac{\pi^2 \times 0.04 \times 20.94^2}{2 \times 1.57^2}$$

$$= \pm 35114.8 \text{ mm/s}^2$$

max acceleration SHM. return stroke

$$(a_r)_{max} = \pm \frac{\pi^2 L \omega^2}{2\theta_r^2} = \pm \frac{\pi^2 \times 0.04 \times 20.94^2}{2 \times 1.047^2}$$

$$= \pm 78956.4 \text{ mm/s}^2$$

(a) A disc cam used for moving a knife edge follower with SHM motion during forward & return in accelerated & retarded. Clockwise 300 rpm. offset of follower 10mm to right side of cam axis. min radius of cam is 30mm. lift of follower 40mm. Lift 60°, dwell 90°, return 120° remaining dwell, draw cam profile find max acceleration & max velocity - [AU. A/M-2003, N/D-2009]

Given:- knife edge follower N=300rpm, offset- 10, cam=30mm lift=40mm. OS-60, RS-120°

Sol.

OS = $60 \times \pi/180 = 1.047$ r, RS = $120 \times \pi/180 = 2.094$ rad

angular velocity $\omega = \frac{2\pi N}{60} = \frac{2\pi \times 300}{60} = 31.41$ rad/s.

max velocity of follower during lift & return.

OS. velocity.

$$(V_o)_{max} = \frac{\pi L \omega}{2\theta} = \frac{\pi \times 0.04 \times 31.41}{2 \times 1.047} = 1.885 \text{ m/s}$$

$$(V_{Rmax}) = -\frac{\pi L \omega}{\theta_r} = \frac{-2 \times 0.04 \times 31.41}{2.094}$$

$$= -1.2 \text{ m/s}$$

max acceleration of follower during lift.

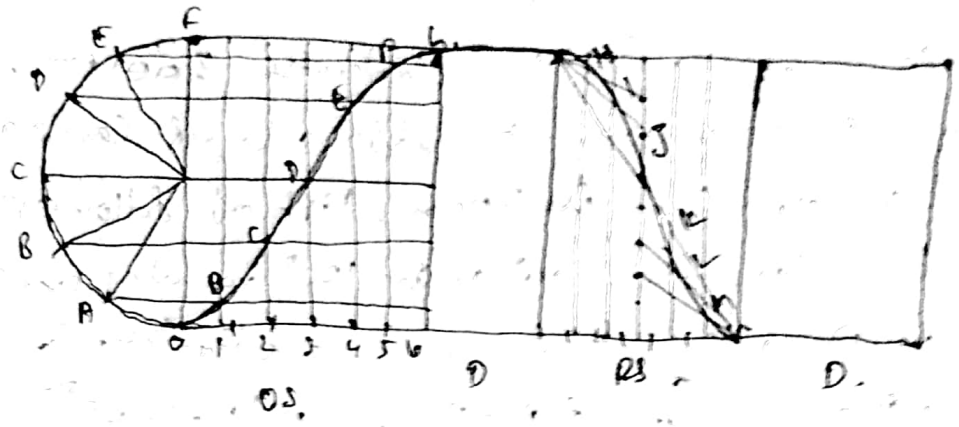
$$(a_o)_{max} = \pm \frac{\pi^2 L \omega^2}{2\theta^2} = \pm \frac{\pi^2 \times 0.04 \times 31.41^2}{2 \times 1.047^2}$$

$$= \pm 177.65 \text{ m/s}^2$$

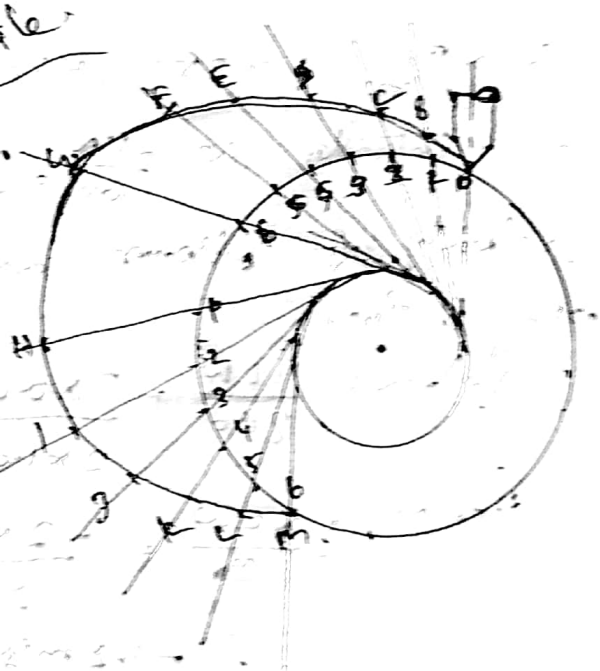
$$(a_{ir})_{max} = \pm \frac{4 L \omega^2}{\theta_r^2} = \pm \frac{4 \times 0.04 \times 31.41^2}{2.094^2}$$

$$= \pm 36 \text{ m/s}^2$$

Displacement diagram.



Cam Profile



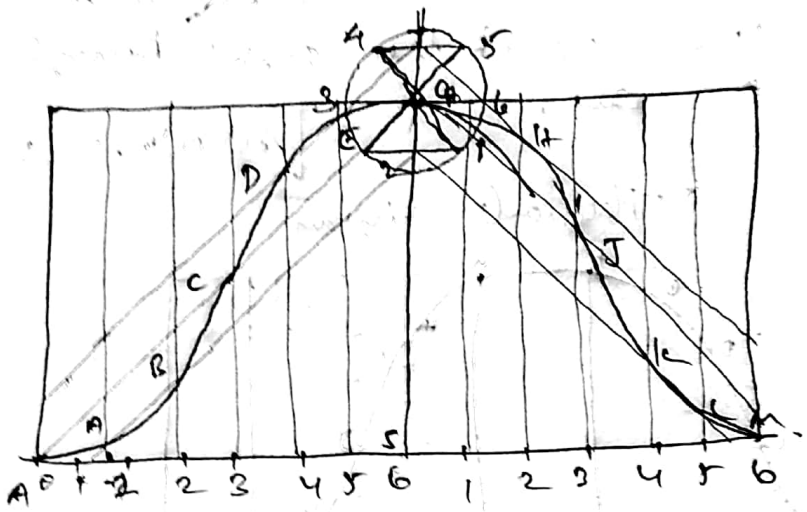
4) "In a Cam Profile roller follower moves with cycloidal motion

1) α_1 = 180°. maximum lift

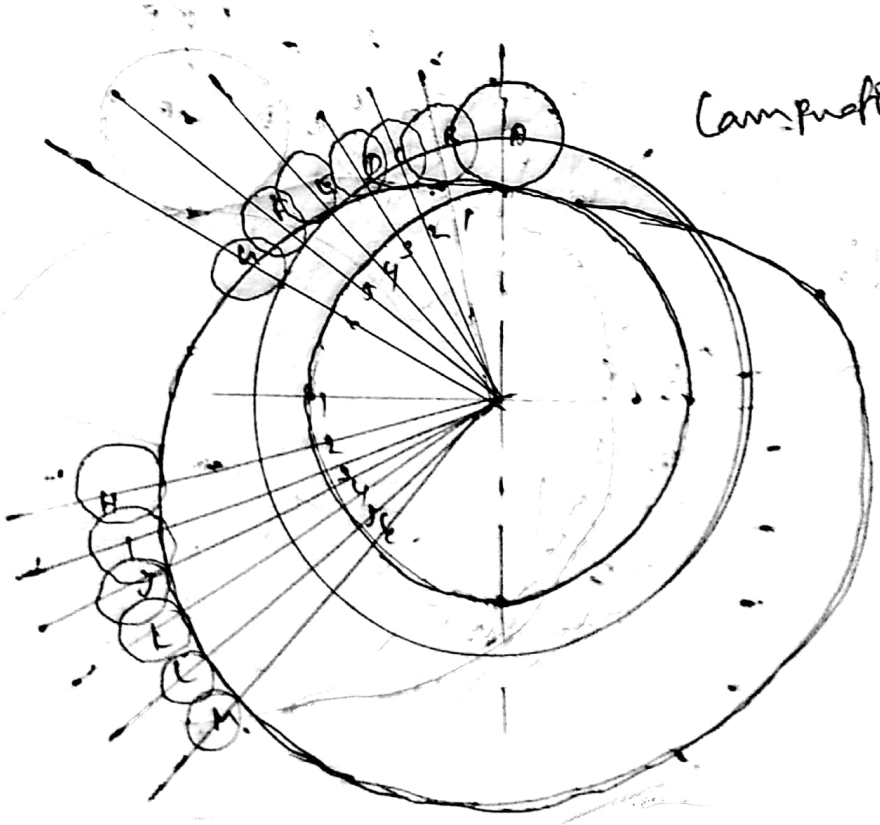
2) β_1 = 150°

3) Dwell = 30°, radius of Cam 20mm dia of roller is 10mm. axis of Cam shaft is passed through the Cam shaft.

(A.U. 2ND/D 2006 AIP 2012)



Displacement diagram.



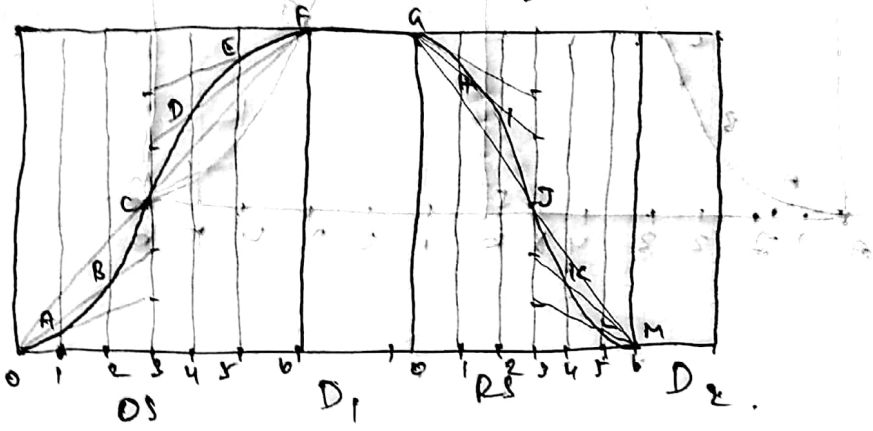
Cam profile

3.) Draw the profile of a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration & retardation during opening & closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation.

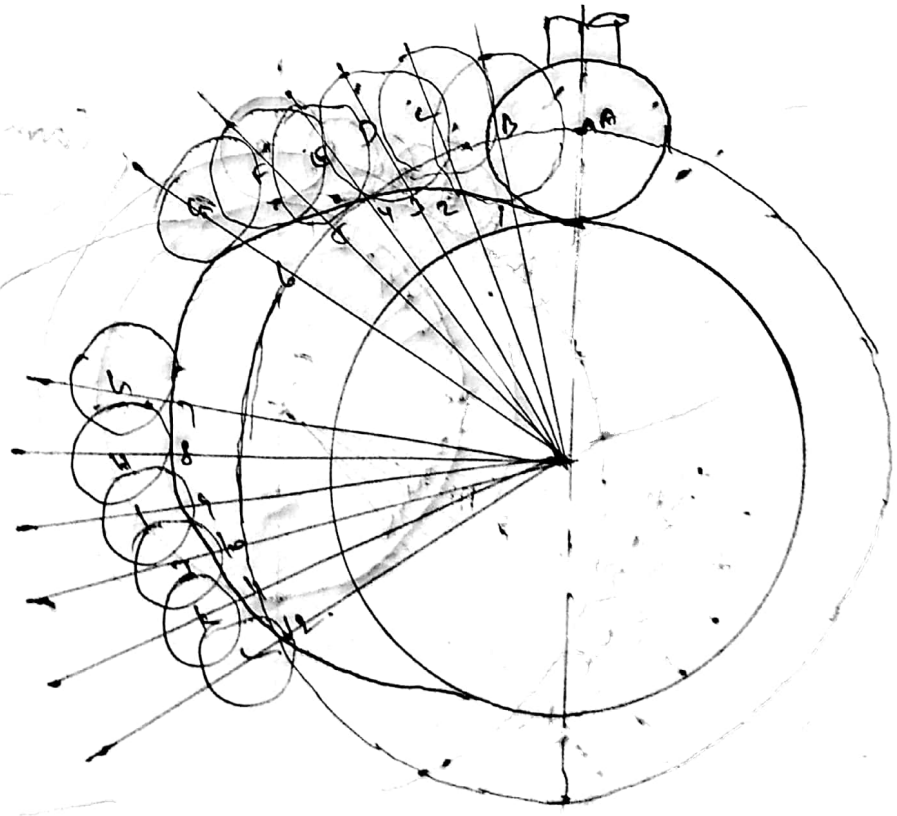
The lift of the valve is 37.5mm & the least radius of cam is 40mm. The follower is provided with a roller radius 20mm. & PB line of stroke passes through the axis of the cam.

[AU N/D-2005, M/J-2009]

Displacement diagram

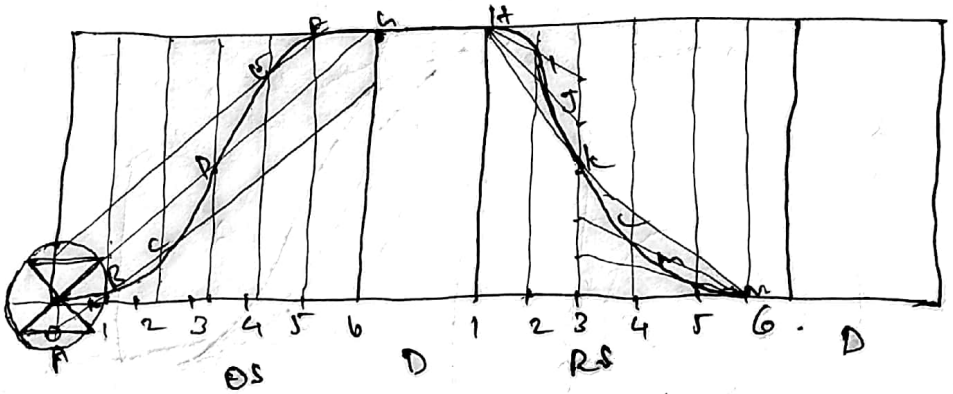


Cam profile.



5) A flat faced mushroom follower is operated by a uniformly rotating cam. The follower is raised through a distance of 25mm in 120° rotation of cam, remains at the next of 30° & lowered during further 120° rotation of cam. The raising of follower takes place with Cycloidal motion & Cam is with uniform acceleration with deceleration. However uniform acceleration is 2/3 of uniform deceleration. radius - 25mm. N = 300rpm.

Displacement diagram.



Compute.