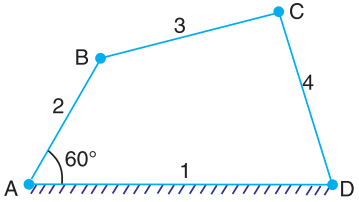

Fig. 6.27

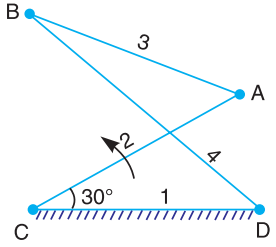

Fig. 6.28

2. Locate all the instantaneous centres for the crossed four bar mechanism as shown in Fig. 6.28. The dimensions of various links are : CD = 65 mm; CA = 60 mm ; DB = 80 mm ; and AB = 55 mm.

Find the angular velocities of the links AB and DB, if the crank CA rotates at 100 r.p.m. in the anticlockwise direction.

[Ans. 50 rad/s ; 27 rad/s]

3. Locate all the instantaneous centres of the mechanism as shown in Fig. 6.29. The lengths of various links are : AB = 150 mm ; BC = 300 mm ; CD = 225 mm ; and CE = 500 mm.

When the crank AB rotates in the anticlockwise direction at a uniform speed of 240 r.p.m. ; find 1. Velocity of the slider E, and 2. Angular velocity of the links BC and CE.

[Ans. 1.6 m/s ; 2.4 rad/s ; 6.6 rad/s]

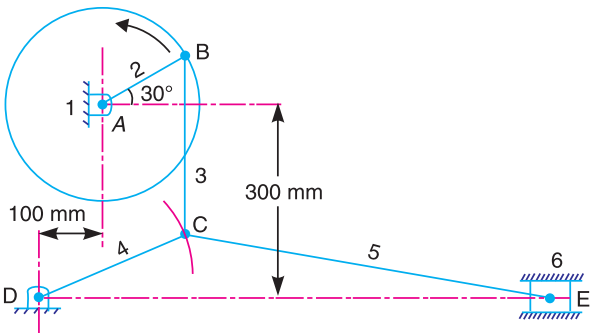

Fig. 6.29

7. Fig. 7.37 shows a mechanism in which the crank *OA*, 100 mm long rotates clockwise about *O* at 130 r.p.m. The connecting rod *AB* is 400 mm long. The rod *CE*, 350 mm long, is attached to *AB* at *C*, 150 mm from *A*. This rod slides in a slot in a trunnion at *D*. The end *E* is connected by a link *EF*, 300 mm long, to the horizontally moving slider *F*.

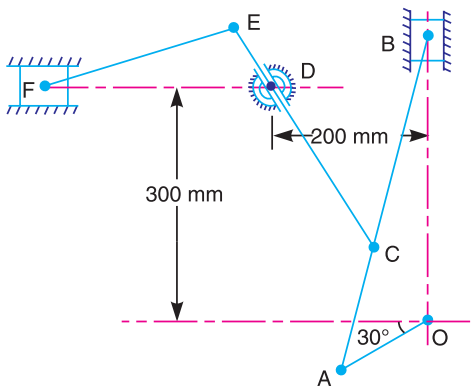

Fig. 7.37

Determine, for the given configuration : 1. velocity of *F*, 2. velocity of sliding of *CE* in the trunnion, and 3. angular velocity of *CE*. **[Ans. 0.54 m/s ; 1.2 m/s ; 1.4 rad/s]**

8. Fig. 7.38 shows the mechanism of a quick return motion of the crank and slotted lever type shaping machine. The dimensions of the various links are as follows :

OA = 200 mm ; *AB* = 100 mm ; *OC* = 400 mm ; and *CR* = 150 mm.

The driving crank *AB* makes 120° with the vertical and rotates at 60 r.p.m. in the clockwise direction. Find : 1. velocity of ram *R*, and 2. angular velocity of the slotted link *OC*.

[Ans. 0.8 m/s ; 1.83 rad/s]

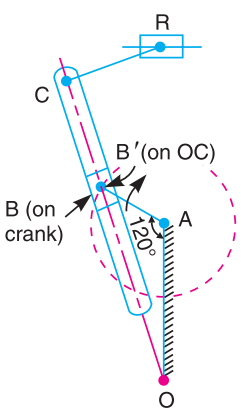

Fig. 7.38

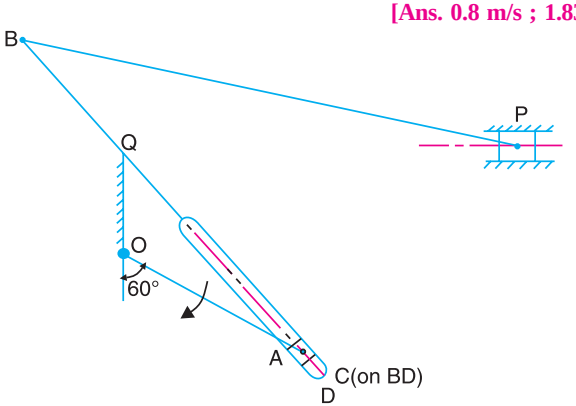

Fig. 7.39

9. In a Whitworth quick return motion mechanism, as shown in Fig. 7.39, the dimensions of various links are as follows :

OQ = 100 mm ; *OA* = 200 mm ; *BQ* = 150 mm and *BP* = 500 mm.

If the crank *OA* turns at 120 r.p.m. in clockwise direction and makes an angle of 120° with *OQ*, Find : 1. velocity of the block *P*, and 2. angular velocity of the slotted link *BQ*.

[Ans. 0.63 m/s ; 6.3 rad/s]

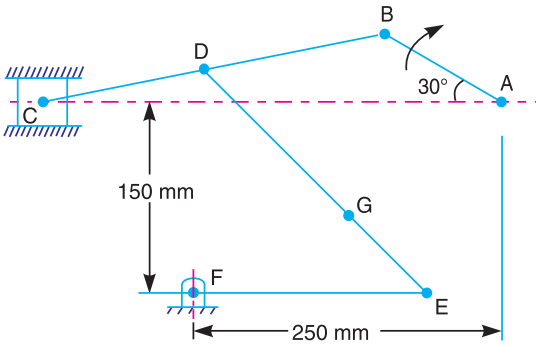

Fig. 8.39

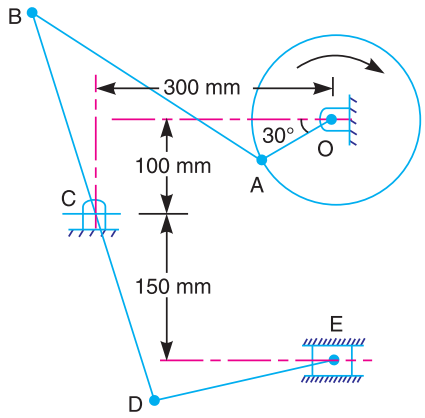

Fig. 8.40

5. In a mechanism as shown in Fig. 8.40, the crank *OA* is 100 mm long and rotates in a clockwise direction at a speed of 100 r.p.m. The straight rod *BCD* rocks on a fixed point at *C*. The links *BC* and *CD* are each 200 mm long and the link *AB* is 300 mm long. The slider *E*, which is driven by the rod *DE* is 250 mm long. Find the velocity and acceleration of *E*.

[Ans. 1.26 m/s; 10.5 m/s^2]

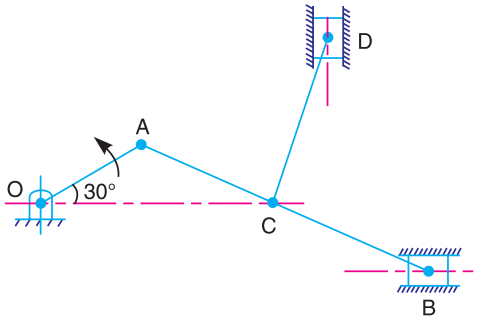

Fig. 8.41

6. The dimensions of the various links of a mechanism, as shown in Fig. 8.41, are as follows:

OA = 80 mm ; *AC* = *CB* = *CD* = 120 mm

If the crank *OA* rotates at 150 r.p.m. in the anti-clockwise direction, find, for the given configuration: 1. velocity and acceleration of *B* and *D* ; 2. rubbing velocity on the pin at *C*, if its diameter is 20 mm ; and 3. angular acceleration of the links *AB* and *CD*.

[Ans. 1.1 m/s ; 0.37 m/s ; 20.2 m/s^2, 16.3 m/s^2 ; 0.15 m/s ; 34.6 rad/s^2; 172.5 rad/s^2]

7. In the toggle mechanism, as shown in Fig. 8.42, *D* is constrained to move on a horizontal path. The dimensions of various links are : *AB* = 200 mm; *BC* = 300 mm ; *OC* = 150 mm; and *BD* = 450 mm.

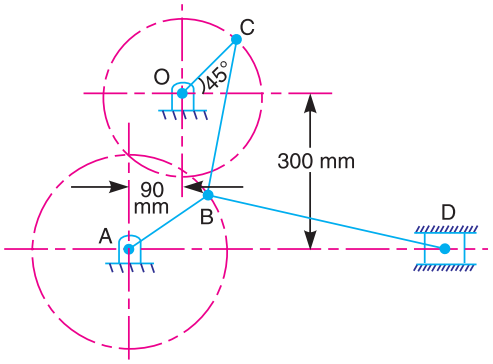

Fig. 8.42

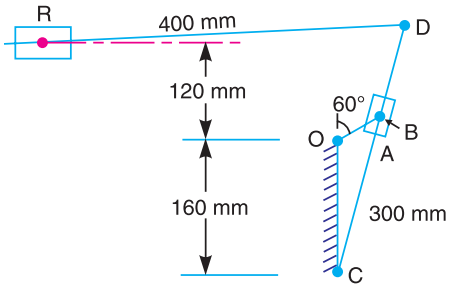

Fig. 8.43

The crank *OC* is rotating in a counter clockwise direction at a speed of 180 r.p.m., increasing at the rate of 50 rad/s^2. Find, for the given configuration 1. velocity and acceleration of *D*, and 2. angular velocity and angular acceleration of *BD*.

8. In a quick return mechanism, as shown in Fig. 8.43, the driving crank *OA* is 60 mm long and rotates at a uniform speed of 200 r.p.m. in a clockwise direction. For the position shown, find 1. velocity of the ram *R* ; 2. acceleration of the ram *R*, and 3. acceleration of the sliding block *A* along the slotted bar *CD*. **[Ans. 1.3 m/s ; 9 m/s^2 ; 15 m/s^2]**

9. Fig. 8.44 shows a quick return motion mechanism in which the driving crank *OA* rotates at 120 r.p.m. in a clockwise direction. For the position shown, determine the magnitude and direction of 1, the acceleration of the block *D* ; and 2. the angular acceleration of the slotted bar *QB*.

[Ans. 7.7 m/s^2 ; 17 rad/s^2]

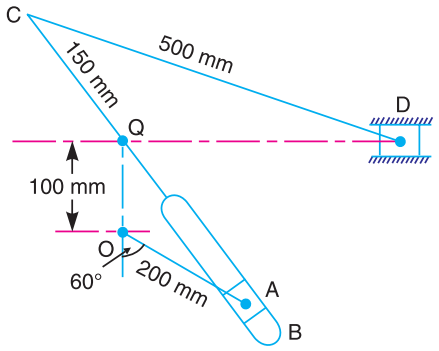

Fig. 8.44

10. In the oscillating cylinder mechanism as shown in Fig. 8.45, the crank *OA* is 50 mm long while the piston rod *AB* is 150 mm long. The crank *OA* rotates uniformly about *O* at 300 r.p.m.

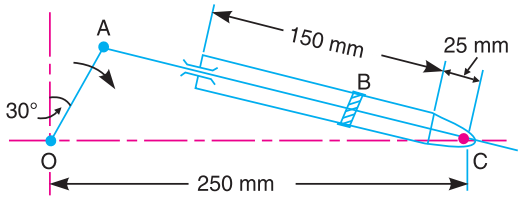

Fig. 8.45

Determine, for the position shown : 1. velocity of the piston *B* relative to the cylinder walls, 2. angular velocity of the piston rod *AB*, 3. sliding acceleration of the piston *B* relative to the cylinder walls, and 4. angular acceleration of the piston rod *AB*.

[Ans. 1.5 m/s ; 2.2 rad/s (anticlockwise) ; 16.75 m/s^2 ; 234 rad/s^2]

11. The mechanism as shown in Fig 8.46 is a marine steering gear, called Rapson's slide. O_2B is the tiller and *AC* is the actuating rod. If the velocity of *AC* is 25 mm/min to the left, find the angular velocity and angular acceleration of the tiller. Either graphical or analytical technique may be used.

[Ans. 0.125 rad/s; 0.018 rad/s^2]

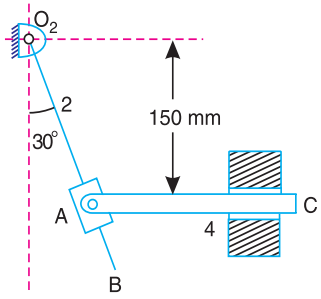

Fig. 8.46