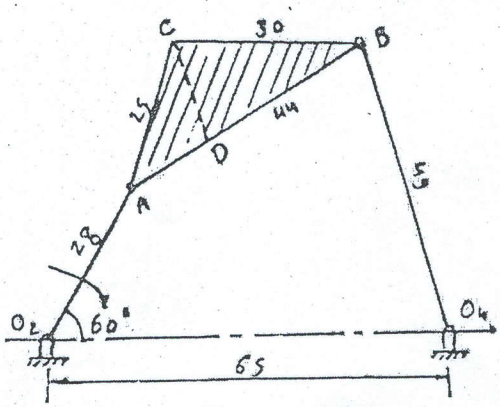
SHEET 1

MECHANISMS

1 Draw the velocity polygon for the mechanism shown in Fig. 26 and determine V_{AIB} , V_{CID} and the angular velocity of link 3. Crank O_2 A rotates at ω radians/sec..

Calculate the values for ω = 100 rad/sec. The length of links are O_2O_4 = 65 mm (fixed) , O_2A = 28 mm , O_4B = 49 mm , AB = 44 mm AC and BC on the link 3 are 25 mm and 30 mm respectively.

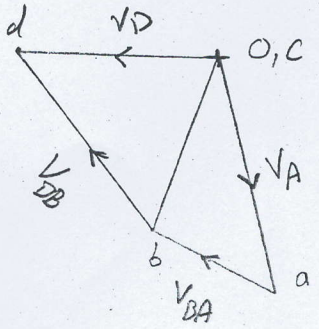


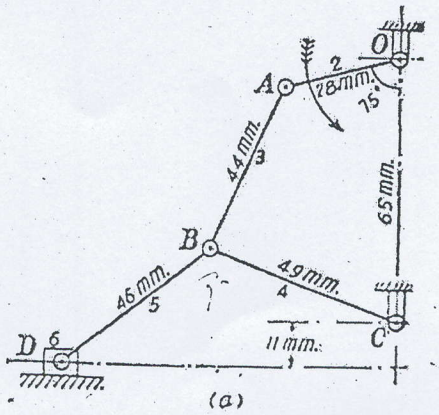
O_2
+

2 In Fig. (2) , the angular velocity of the crank OA is 600 rpm . Determine the linear velocity of the slider 6 and the angular velocity of the link 5, when the crank is inclined at an angle of 75° to the vertical. The dimension of various links are OA = 28mm, AB = 44mm, BC = 49mm, BD = 46 mm, and the center distance between the centers of rotation O and C is 65 mm. Path of the travel of slider is 11mm velocity below fixed point C.

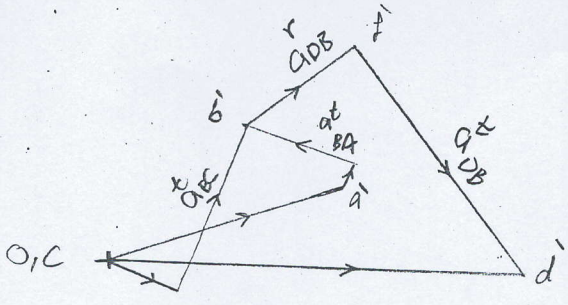
take $N_{OA} = 100$ r.p.m

$$\omega_{OA} = \frac{2\pi N}{60} = \frac{2\pi * 100}{60} = 10 \text{ rad/s}$$

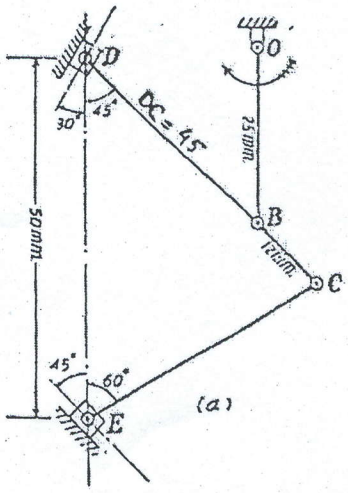




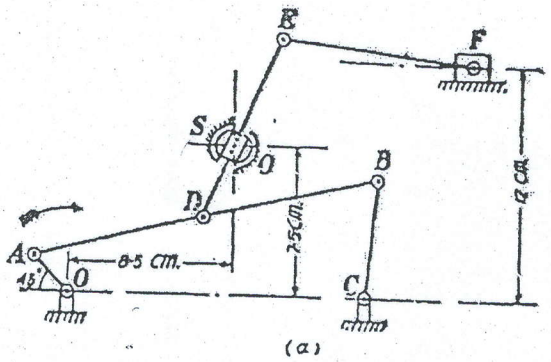
Configuration diagram : Scale 1 mm. = 2 m
Velocity polygon : Scale 1 mm. = 50 mm/sec
Fig. 2



3 Construct the velocity diagram for the mechanism shown in Fig. (3) (a), and determine the angular velocity of link DC and EC, if the speed of the crank OB is 60 rad/sec. OB is vertical in the given configuration. DC = 45 mm is one link with turning pair of B with DB.



4 In the swiveling point mechanism shown in Fig. (4) (a) OB = 2.5 cm, link AB = 18 cm, AD = EB, DE = 100 cm. Distance between fixed point O and C is 5 cm. Crank OA rotates at 200 rpm. Determine the acceleration of sliding of link DE in the trunnion.



(a)

5 The Kinematic diagram of one the cylinders of a rotary engine is shown in Fig. **(5)**. OA is the crank which is vertical and fixed; this is 7.5 cm long; AP is the connecting rod 25 cm long. The line of stroke OP is inclined at 30° to the vertical in the position shown in the figure. The cylinders are all rotating at a uniform speed of 900 rpm about the fixed center O. Determine the acceleration of the piston inside the cylinder and the angular acceleration of the connecting rod.

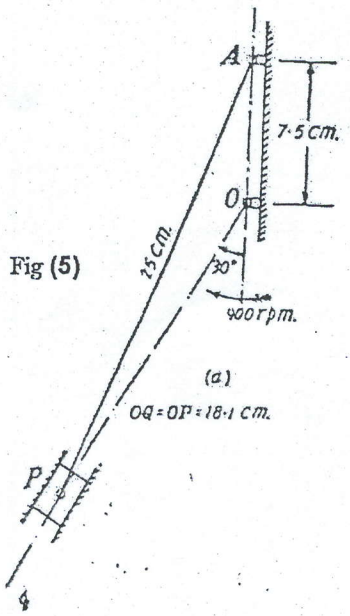


Fig (5)

6 Fig. (6) shows Andrean Variable Stroke Mechanism in which the links 2 and 7 have a rolling contact without slipping. Construct the acceleration diagram and determine the linear acceleration of the slider block *D* and also the angular acceleration of links *AC*, *CD* and *CB*.

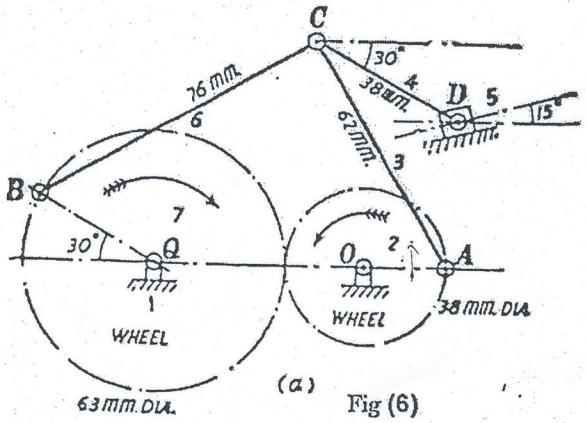
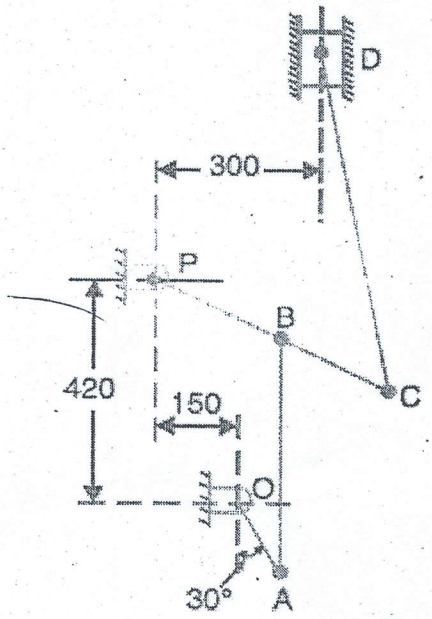


Fig (6)

7 Find out the acceleration of the slider D and the angular acceleration of link CD for the engine mechanism shown in Fig. 7. The crank OA rotates uniformly at 180 r.p.m. in clockwise direction. The various lengths are: OA = 150 mm ; AB = 450 mm; PB = 240 mm ; BC = 210 mm ; CD = 660 mm.

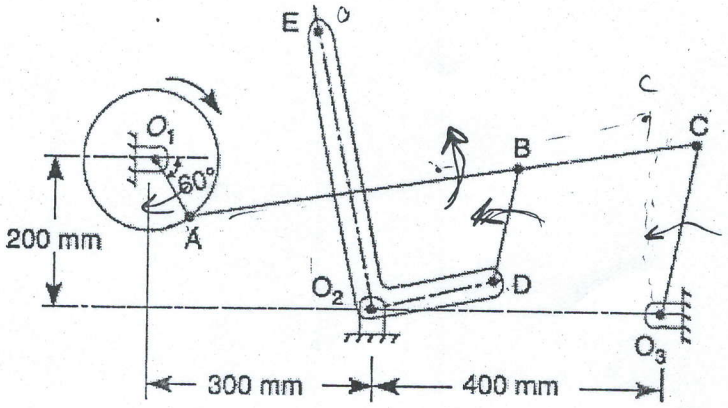


All dimensions in mm.

8 The mechanism of a warping machine, as shown in Fig. 8.18, has the dimensions as follows:

$O_1A = 100$ mm; $AC = 700$ mm ; $BC = 200$ mm ; $BD = 150$ mm ; $O_2D = 200$ mm ; $O2E = 400$mm ; $O_3C = 200$ mm. The crank O_1A rotates at a uniform speed of 100 rad/s. For the given configuration, determine:

- Linear velocity of the point E on the bell crank lever,
- Acceleration of the points E and B, and 3. Angular acceleration of the bell crank lever.

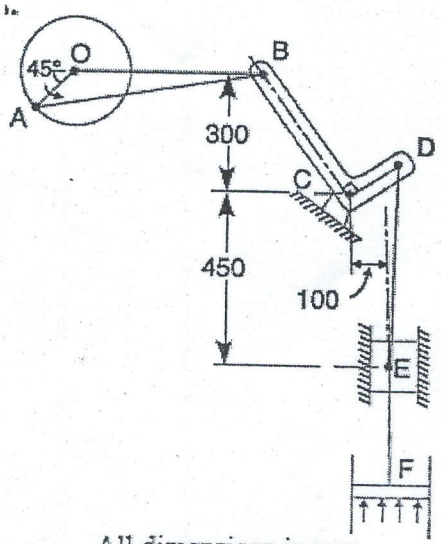


9 A pump is driven from an engine crank-shaft by the mechanism as shown in Fig. The pump piston shown at F is 250 mm in diameter and the crank speed is 100 r.p.m. The dimensions of various links are as follows:

OA = 150 mm ; AB = 600 mm ; BC = 350 mm ; CD = 150 mm; and DE = 500 mm.

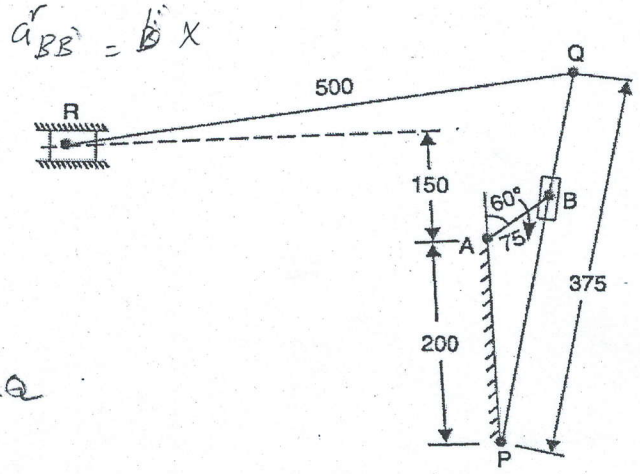
Determine for the position shown :

- The velocity of the cross-head E,
- The rubbing velocity of the pins A and B which are 50 mm diameter.
- The torque required at the crank shaft to overcome a pressure of 0.35 N/mm2,
- And the acceleration of the cross-head E.

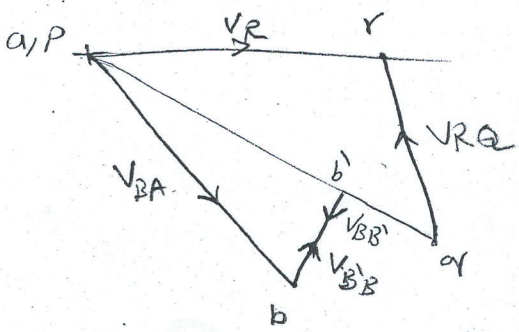


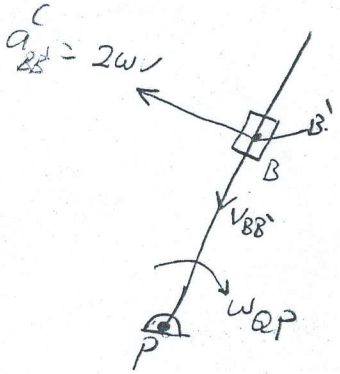
All dimensions in mm.

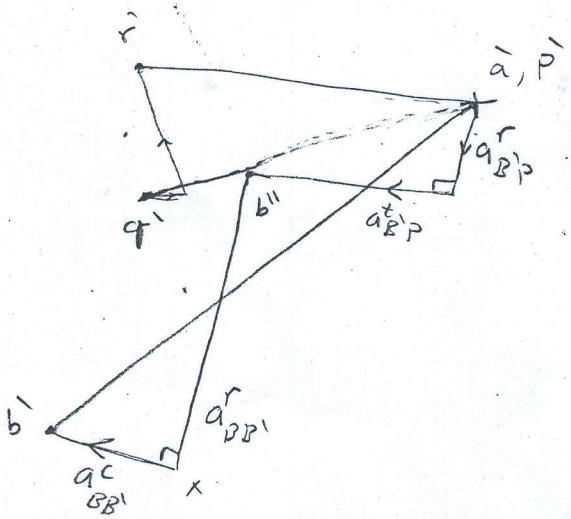
10 The driving crank AB of the quick-return mechanism, as shown in Fig. 8.30, revolves at a uniform speed of 200 r.p.m. Find the velocity and acceleration of the tool-box R, in the position shown, when the crank makes an angle of 60° with the vertical line of centres PA. What is the acceleration of sliding of the block at B along the slotted lever PQ ?



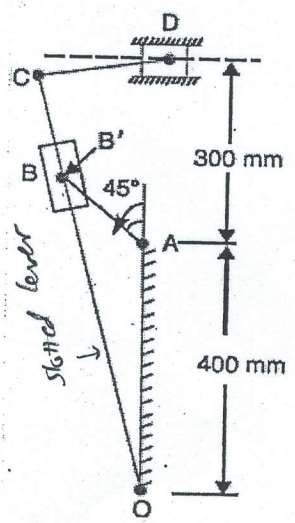
All dimensions in mm.







11 A mechanism of a crank and slotted lever quick return motion is shown in Fig. If the crank rotates counter clockwise at 120 r.p.m., determine for the configuration shown, the velocity and acceleration of the ram D. Also determine the angular acceleration of the slotted lever. Crank, AB=150mm; Slotted arm, OC= 700mm and link CD = 200mm.



Benha University
Shoubra Faculty of Engineering
Theory of mechanisms and machines

2 nd year Mechanical (Power)
Mid-Term Exam 2nd semester 2014 / 2015
Time Allowed 1.0 Hrs.

1- The shown mechanism fig (1) is drawn to scale of length $m_L = 10$ cm /cm .
The link 2 rotates with angular velocity $\omega_{21} = 20\ s^{-1}$ and the angular acceleration $\varepsilon_{21} = 50\ s^{-2}$.
Obtain the velocity and acceleration of points B & C .
Obtain also the angular velocities and angular accelerations of links 4 & 5.

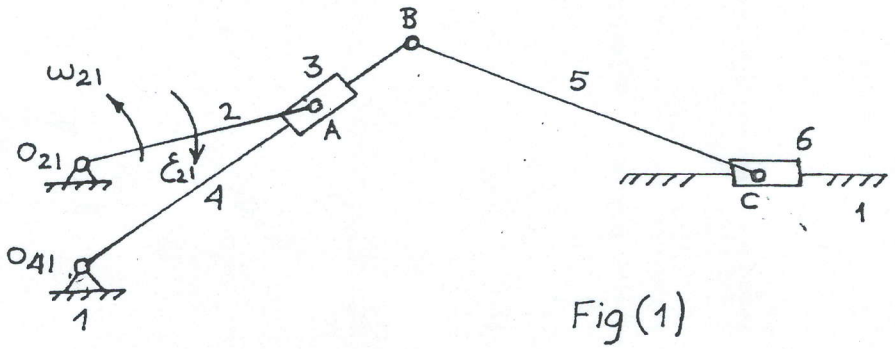


Fig (1)