

N.B. 1) Question No.1 is compulsory.

2) Attempt any three questions out of the remaining five questions.

3) Figures to the right indicate full marks.

4) Assume suitable data wherever required but justify the same.

Q1. Attempt any four

(20)

A. State and explain Grashoff's law.

B. Prove that the elliptical trammel can trace an ellipse as well as a circle.

C. Prove that the velocity of sliding is proportional to the distance of the point of contact from the pitch point with respect to gears.

D. Define the terms trace point, pitch point and stroke with respect to cams with the help of neat sketch.

E. What are the different types of Instantaneous centers?

Q2 A. A uniform bar of mass 'm' and length 'L' hangs from a frictionless hinge. It is released from the horizontal position. Find the angular velocity of the center of mass 'G', when it is in vertical position. Solve by work energy principle. (8)

B. A pair of gear, having 40 and 30 teeth, respectively is of  $25^\circ$  involute form. The addendum length is 5 mm and module is 2.5 mm. If the smaller wheel is driver and rotates at 1500 rpm, find the velocity of sliding at the point of engagement and at the point of disengagement. (12)

Q3 A. Sketch a Pantograph, explain its working and show that it can be used to reproduce an enlarged scale of a given figure. (8)

B. Two gears having 40 and 50 involute teeth respectively are in mesh. The module of gears is 10 mm and pressure angle is  $20^\circ$ . The line of contact on each side of the pitch point is two third of maximum possible length. Find addendum on pinion and gear, length of path of contact and contact ratio. (12)

Q4 A. Derive the condition for transmitting the maximum power in a flat belt drive and find the velocity of the belt for the maximum power. (8)

B. A cam with a minimum radius of 50 mm, rotating clockwise at a uniform speed is required to give a knife edge follower the motion as described below; (12)

i) To move outwards through 40 mm during  $100^\circ$  rotation of the cam.

ii) To dwell for next  $80^\circ$ .

iii) To return to its starting position during next  $90^\circ$

iv) To dwell for the rest period of revolution.

Draw the profile of the cam when the line of stroke of the follower passes through the center of the cam shaft.

The displacement of the follower is to take place with uniform acceleration and retardation motion. Determine the maximum velocity and acceleration of the follower when the cam shaft rotates at 900 rpm.

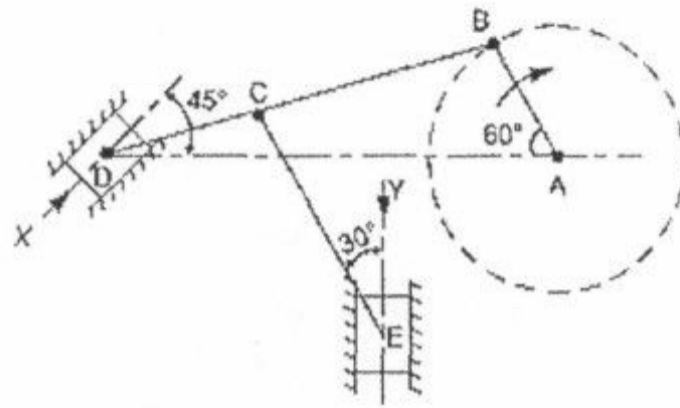
Draw the displacement, velocity and acceleration diagram for one revolution of the cam.

TURN OVER

Q5 A. Derive the equation for the length of a chain with the help of neat sketch. (8)

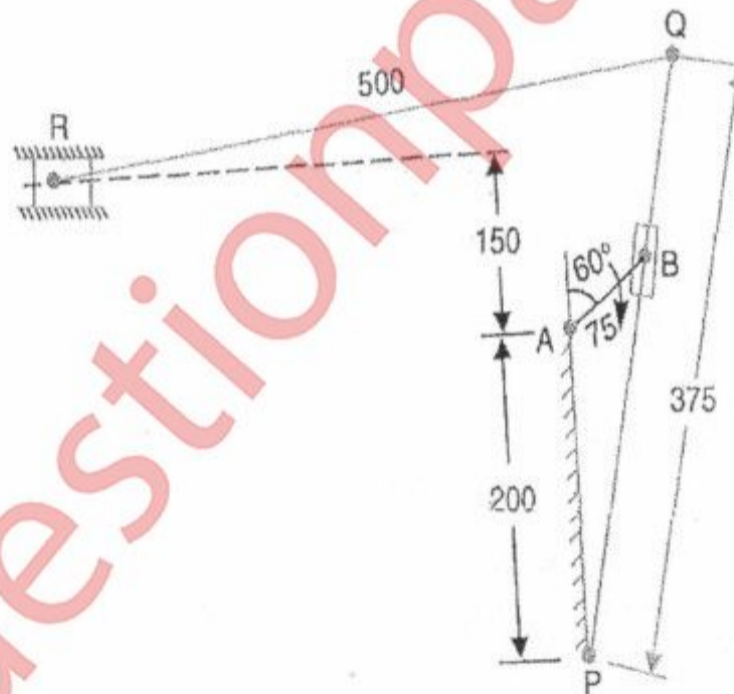
B. The dimensions of a mechanism as shown in the figure are as follows: (12)

$AB = 0.45 \text{ m}$ ,  $BD = 1.5 \text{ m}$ ,  $BC = CE = 0.9 \text{ m}$ .



The crank AB turns uniformly at 180 rpm in the clockwise direction and the blocks at D and E are working in frictionless guides. Draw the velocity diagram for the mechanism and find the velocities of the sliders D and E in their guides.

Q6 A. The driving crank AB of the quick return mechanism as shown in figure revolves at a uniform speed of 200 rpm. Find the velocity and acceleration of the toolbox R, in the position shown, when the crank makes an angle of  $60^\circ$  with the vertical line of centres PA. What is the acceleration of sliding of the block at B along the slotted lever PQ? (14)



All dimensions in mm.

B. Classify followers in detail. (6)