Time : 3 Hours **Marks : 80**

N.B: 1) Question No. 1 is **compulsory.**
2) Attempt any **three** questions out of remaining **five** questions
3) Assume suitable data wherever necessary but justify the same
4) Figures to the right indicate Marks

Q1 Solve any Four (20)

1. Explain with neat sketch and example types of constrained motion
2. State any Five CAM terminology
3. Comparison of Cycloidal and Involute tooth forms
4. Classify various types of brakes
5. State and explain DAlemberts Principle

2 (a) Fig 1 shows a mechanism in which OA = QC = 100 mm AB =QB = 300 mm CD = 250 mm. The crank OA rotates at uniform speed of 150 rpm in clock wise direction. Determine the (a) velocity of slider at D (b) angular velocities of links QB and AB (c) rubbing velocity at the pin B which is 50 mm in diameter (12)

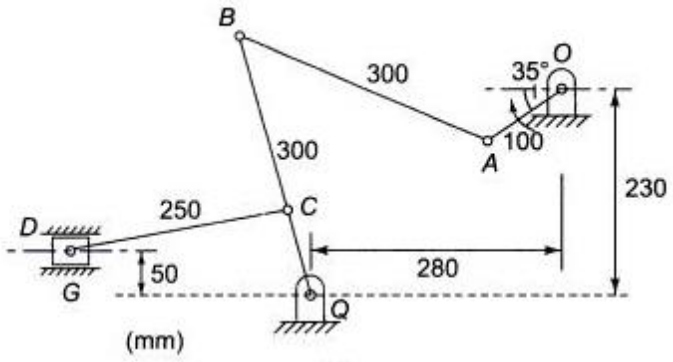
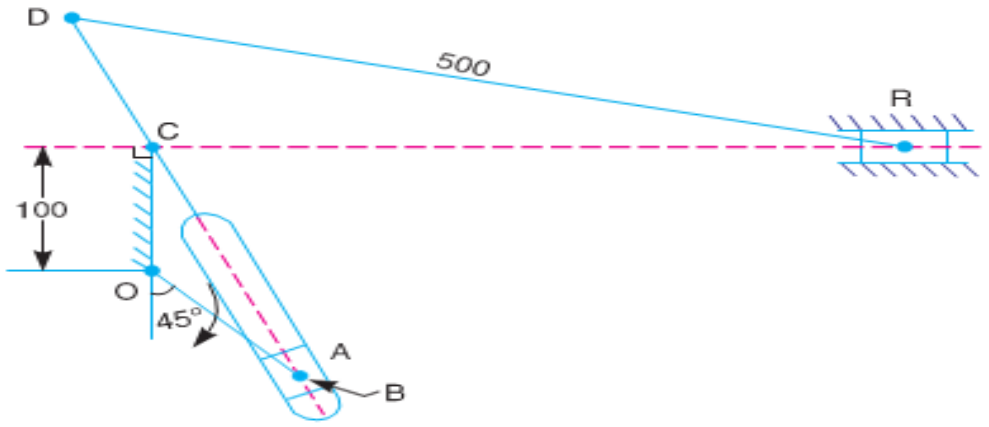


fig 1

(b) Derive the equation for drawing exact straight line using HARTS mechanism (8)

Q 3 (a) In a Whitworth quick return motion, as shown in Fig. 2. OA is a crank rotating at 30 r.p.m. in a clockwise direction. The dimensions of various links are: OA = 150 mm; OC = 100 mm; CD = 125 mm; and DR = 500 mm. Determine the acceleration of the sliding block R and the angular acceleration of the slotted lever CA. (14)



All dimensions in mm.

fig 2

(b) With neat sketch explain elliptical trammel (6)

Q 4 (a) Two involute gears in mesh have 20° pressure angle. The gear ratio is 3 and the number of teeth on the pinion is 24. The teeth have a module of 6 mm. The pitch line velocity is 1.5 m/s and the addendum equal to one module. Determine the angle of action of pinion and the maximum velocity of sliding. (10)

(b) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter running at 250 r.p.m. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m^3 and thickness of belt 10 mm, determine the width of the belt taking centrifugal tension into account. (10)

Q 5 (a) A roller follower is operated by a uniform rotating cam. The follower is raised through a distance of 25 mm in 120º rotation of the cam, remains at rest for next 30º and is lowered during further 120º rotation of the cam. The raising of the follower takes place with cycloidal motion and the lowering with uniform acceleration and deceleration. The least radius of the cam is 25 mm which rotates at 300 rpm. Plot displacement, velocity and acceleration curves and find the values of the maximum velocity and maximum acceleration during rising and return stroke of the follower. (14)

(b) Classify various types of chains with suitable examples (6)

Q 6 (a) Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m., find the speed of shaft B. (10)

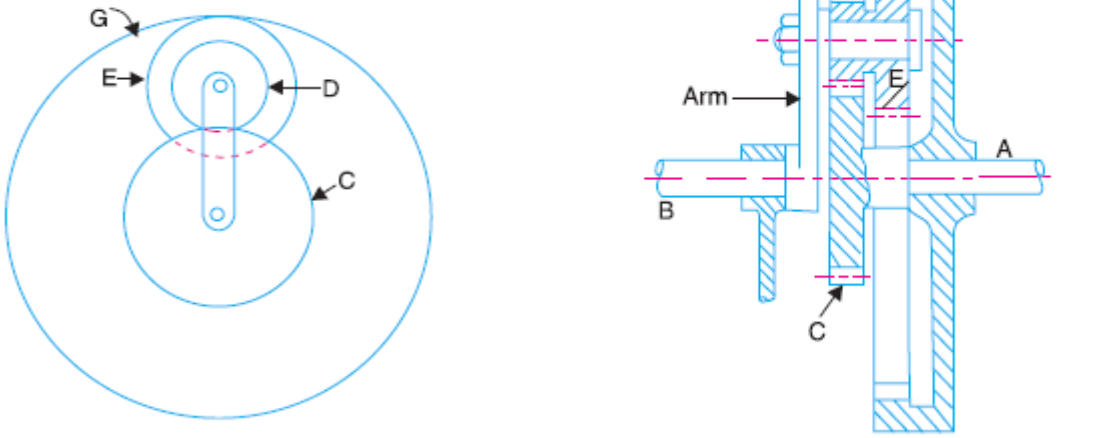


fig 3

(b) State and explain Kennedy's theorem (5)

(c) Classify kinematic pairs with suitable example (5)