

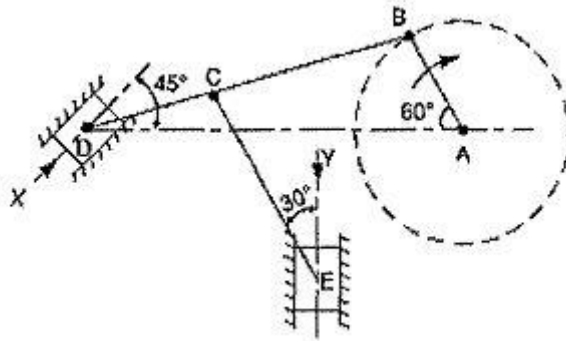
(3 Hours)

Total Marks 80

- NB**
1. Question No. 1 is Compulsory.
 2. Attempt any three questions out of remaining 5 questions.
 3. Figures to the right indicates full marks.
 4. Assume suitable data wherever necessary but justify the same.

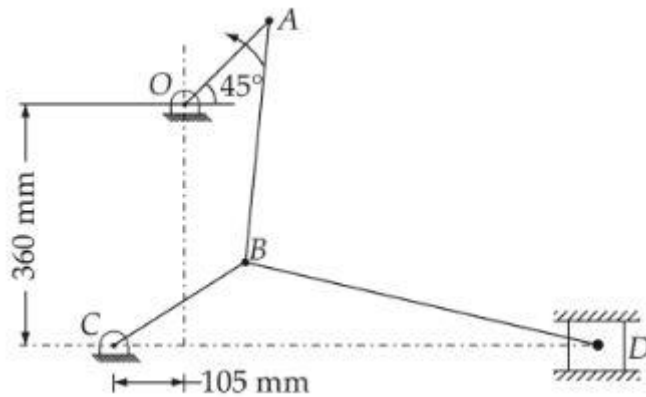
- Q.1. Attempt any Four. (20)**
- a) State and derive law of Gearing.
 - b) Differentiate between lower pair and higher pair.
 - c) What is crowning of pulley in flat belt drives.
 - d) Define base circle, pitch circle, trace point, pitch curve and pressure angle.
 - e) What is instantaneous centre of rotation? How to find number of instantaneous centres in mechanism?

- Q.2. a) The dimensions of a mechanism as shown in the figure are as follows: (10)**
 $AB = 0.45 \text{ m}$, $BD = 1.5 \text{ m}$, $BC = CE = 0.9 \text{ m}$.
 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 using relative velocity method.



- b) Explain self-locking and self-energizing brakes. (05)
 - c) With neat sketch explain interference in involute gears. (05)
- Q.3. a) A v-belt having face width equal to 22 mm and nominal thickness equal to 14 mm is used to transmit power with 'V' groove angle 40° . If the mass of the belt is 0.4 kg/m and maximum allowable stress is 1.5 N/mm^2 , determine the maximum power that can be transmitted. Angle of contact is 155° and co-efficient of friction is 0.2. (10)**
- b) A cam with a minimum radius of 25 mm is to be designed for a knife edge follower (10)**
 with the following data :—
 (i) To raise the follower through 35 mm during 60° rotation of the cam.
 (ii) Dwell for the next 40° of the cam rotation.
 (iii) Descending of the follower during the next 90° of the cam rotation.
 (iv) Dwell during the rest of the cam rotation.
 If the ascending and descending of the cam is with SHM and UARM respectively.
 Calculate maximum values of velocity, acceleration, and jerk if the cam rotates at 150 rpm.

- Q.4.** a) In an epicyclic gear train an annular wheel A having 54 teeth meshes with a planet wheel B which gears with a sun wheel C, the wheel A and C being co-axial. The wheel B is carried on a pin fixed on one end of arm P which rotates at 100 rpm about the axis of the wheel A and C. If the wheel A makes 20 rpm in clockwise sense and the arm rotates at 100 rpm in anti-clockwise direction and C has 24 teeth, Sketch the arrangement and determine rpm and sense of rotation of wheel C (10)
- b) In the toggle mechanism shown in Fig. the slider D is constrained to move on a horizontal path. The crank OA is rotating in the counter clockwise direction at a speed of 180 r.p.m. increasing at the rate of 50 rad/sec. The dimensions of the various links are as follows: OA = 180 mm; CB = 240 mm; AB = 360 mm and BD = 540 mm. For the configuration given, find acceleration of the slider D. (10)



- Q.5.** a) 2.5 kW of power is transmitted by an open-belt drive. The linear velocity of the belt is 2.5 m/s. The angle of lap on the smaller pulley is 165° . The coefficient of friction is 0.3. Determine the effect on power transmission in the following cases: (10)
- Initial tension in the belt is increased by 10%
 - Initial tension in the belt is decreased by 10 %
 - Angle of lap is increased by 10% by the use of an idler pulley, for the same speed and the tension on the tight side.
- b) Explain Chordal action in chain drive. (05)
- c) Derive an expression for centrifugal tension in belt. (05)

- Q.6.** Attempt any four. (20)
- Explain gear terminology.
 - Explain slip and creep in belt drive .
 - With neat sketch explain interference in involute gears.
 - Why Cycloidal motion of follower is preferred for high speed applications? Explain with suitable sketch.
 - Explain with neat sketch fundamental equation of steering gears for correct gearing.