

(3 Hours)

[Total Marks: 80]

- 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.

1. Write short note on **any 4** of the following

[20]

- (a) Compliant mechanisms
- (b) Complex mechanisms.
- (c) Classification of synthesis problems.
- (d) Slip in belts
- (e) Classification of cams

2. (a) A homogeneous sphere of weight 120 N rolls along a 30° incline without slipping as shown in figure 1. The radius of the sphere is 100 mm. determine the acceleration of the sphere. [6]

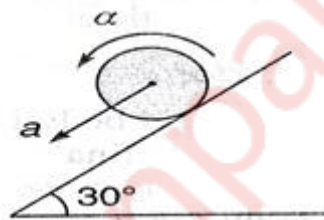


Figure 1

(b) Fig. 2 shows a six-link mechanism. The dimensions of the links are OA = 220 mm, AB = 485 mm, BQ = 310 mm, BC = 590 mm and CD = 400 mm. for the position when the crank OA makes an angle of 60° with the vertical, find the the velocity of the slider D by ICR method. the crank OA rotates clockwise at 150 rpm. [8]

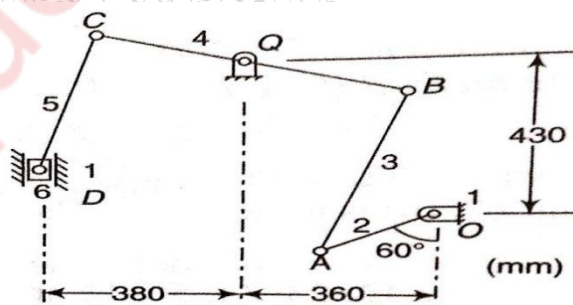


Figure. 2

(c) Define Grashof's law. State how is it helpful in classifying the four-link mechanisms into different types. [6]

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3. (a). In the toggle mechanism shown in figure 3, the crank OA rotates at 210 rpm counter-clockwise [14]
 increasing at the rate of 60 rad/s^2 . for the given configuration, determine
 (i) velocity of slider D and the angular velocity of link BD
 (ii) acceleration of slider D and the angular acceleration of link BD

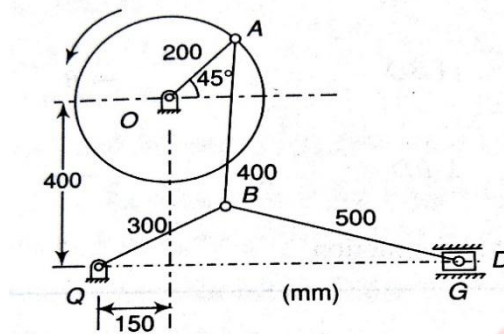


Figure 3

- (b) Write short note on any one straight line generating mechanism. [6]
4. (a) Design a four-link mechanism to coordinate three positions of the input and the output links [12]
 for the following angular displacements:
 $\theta_{12} = 60^\circ$ $\phi_{12} = 30^\circ$
 $\theta_{13} = 90^\circ$ $\phi_{13} = 50^\circ$
- (b) Two involute gears in mesh have 20° pressure angle. The gear ratio is 3 and the number of teeth on [8]
 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
 (i) Path of contact
 (ii) Arc of contact
 (iii) Contact ratio and
 (iv) The maximum velocity of sliding
5. (a) An open belt drive transmits 4 kW of power. The smaller pulley is the driver and rotates at [10]
 300 rpm. The diameters of the two pulleys are 280 mm and 640 mm and the centre distance is 3 m. the
 coefficient of friction between the belt and the pulley is 0.3. if the safe working stress is 8 n/mm width,
 determine the
 (i) minimum width of the belt.
 (ii) Initial tension in the belt and
 (iii) Length of belt required.
- (b) Explain the term: function generation and path generation. [5]
- (c) What do you mean by dimensional synthesis of a pre-conceived type mechanism? [5]

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6. (a) Draw the profile of a cam operating a knife edge follower having a lift of 30mm. The cam raises [14]
the follower with SHM for 150° of the rotation followed by a period of dwell for 60° . The follower
descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell
period. The cam rotates at uniform velocity of 150 rpm and has a least radius of 30mm.
What will be the maximum velocity and acceleration of the follower during lift and return?
- (b) Make a comparison of cycloidal and involute tooth forms. [6]
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