

Answer any five questions

- Q1.a) Prove that i) minimum number of binary links in a constrained mechanism with simple hinges is four,
ii) maximum number of hinges on one link in a constrained mechanism with N links is $N/2$
2X5
- b) Explain the following (any two): i) Aronhold – Kennedy theorem, ii) Coriolis component, iii) Chebyshev's spacing 10
- Q2.a) Determine the DOF of the three linkages shown in Fig.I 6
- b) What is an 'Equivalent Linkage'? Draw an equivalent linkage of the linkage shown in Fig.II 7
- c) What is 'Kinematic Inversion'? Make sketch of two kinematic inversion of Slider–Crank mechanism. 7
3. . Determine the angular velocity at point B,C & D of the mechanism shown in Fig.III . Also evaluate the Angular velocity of link 5 & 6
4. Construct the profile of a disk Cam with translating roller follower undergoing S.H.M. using the following data: Base Circle diameter = 15 cm, Roller diameter = 1.5 cm, lift = 5 cm in 180° of cam rotation & return in 135° and rest is dwell. Cam rotates in clockwise direction at 300 rpm. 20
- 5.Design a slider crank mechanism such that the displacement of the slider is proportional to the square of the crank rotation in the interval $30^\circ < \theta < 150^\circ$. Use three point Chebyshev spacing. 20
- 6.a) With suitable examples classify gears on the basis of : i) position of shafts, ii) form of tooth profile. What is a 'Reverted Gear Train'? 7
- b) Two straight teeth bevel gears having 32 and 48 teeth are to be mounted on shafts whose axes are at an angle of 120° with each other. Determine the pitch angles of the gears. 5
- c) In a machine, a wide roller, 250 mm in diameter is mounted on shaft A which is driven by a motor carrying a pulley B of 150 mm diameter. The pulley in turn drives another pulley of 1200 mm diameter mounted on shaft C. On the same shaft a spur gear of 20 teeth is mounted, which is meshed with a spur gear of 160 teeth mounted on shaft D. The shaft D also carries a spur gear of 20 teeth which drives a 30 teeth gear on shaft A through an idler of 112 teeth mounted on shaft E. Sketch the arrangement and determine the speed of a belt conveyor running on the wide roller. 8

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7. For the Linkage shown in Fig.IV determine the acceleration of the slider 6 and angular acceleration of Link 3 and 5. 20
- 8.a) Classify Cam followers with (suitable diagrams) according to : i) it's movement w.r.t. the Cam & ii) Nature of its surface in contact with the Cam surface. 6
- b) For the same Cam Follower combination of Q.4, determine the Displacement, Velocity, Acceleration & Jerk of the follower for Cam rotation of 30° , 60° , 90° & 120° . Draw the degree of Cam rotation Vs. Velocity and Acceleration graph. 14
9. The three conditions to be satisfied by a Four-bar linkage are : $\theta_2 = 60^{\circ}$, $\theta_4 = 120^{\circ}$, $\omega_2 = 4$ radian/second, $\omega_4 = 3$ radian/second, $\alpha_2 = -2$ radian/sec.², $\alpha_4 = 0$. Determine the link length ratios. 20

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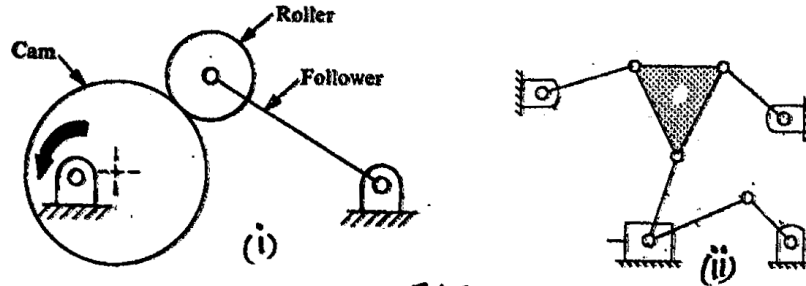


FIG. 1

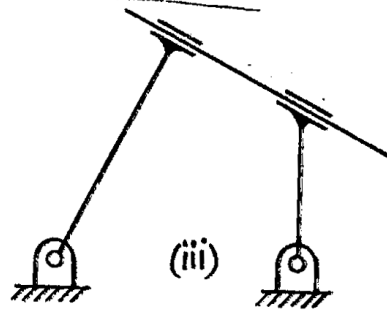
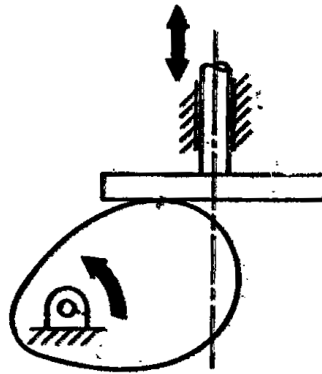


FIG I



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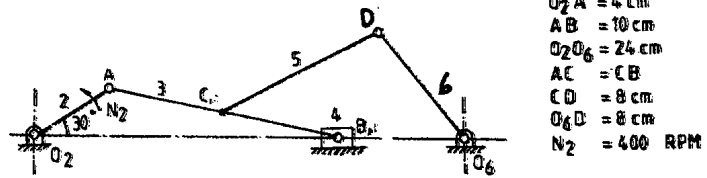
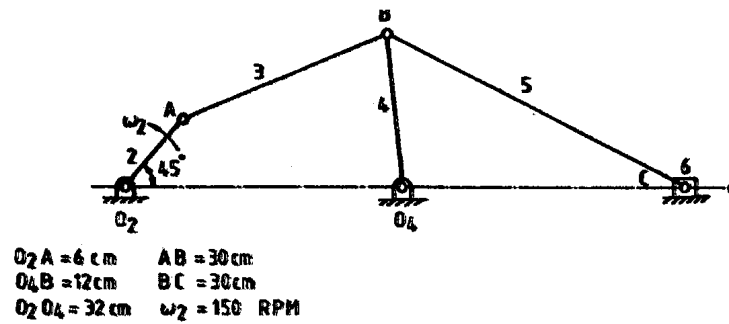


FIG. III



FIGIV