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PART – C

(1×15=15 Marks)

16. a) ABCD is a four bar chain with link AD fixed. The length of the links are AB = 190 mm, BC = 280 mm, CD = 280 mm, and AD = 500 mm. The crank AB has an angular velocity of 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle BAD = 55° and B and C lie on same side of AD. Find the acceleration and angular acceleration of links BC and CD.

(OR)

b) Design a cam for operating exhaust valve of an oil engine. It is required to give simple harmonic motion during opening of valve with 120° of cam rotation and simple harmonic motion during closing of the valve with 60° of cam rotation. The valve must remain in the fully open position for 30° of cam rotation. The lift of the valve is 50 mm and the least radius of the cam is 25 mm. The follower is provided with a roller of radius 10 mm and its line of stroke passes through the axis of the cam.

**Question Paper Code : 50859**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017  
 Third/Fourth Semester  
 Mechanical Engineering  
 ME 6401 – KINEMATICS OF MACHINERY  
 (Regulations 2013)

(Common to : B.E. Mechanical Engineering (Sandwich)/Mechatronics Engineering)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A

(10×2=20 Marks)

1. Define the Grubler's criterion for plane mechanism with mathematical expression.
2. Name any two inversions of single slider crank chain.
3. Define Coriolis component of acceleration.
4. State the Arnold Kennedy theorem.
5. Differentiate between radial cam and cylindrical cam.
6. Name the cam follower extensively used in air-craft engines.
7. What is meant by crossed belt drive ?
8. Write the conditions for the maximum power transmission by a belt from one pulley to another.
9. Give the classification of gears based on position of teeth on the wheel.
10. Draw the compound gear train and write its speed ratio.



11. a) Write in detail with neat sketch, any three inversions of double slider crank chain.

(OR)

- b) Describe with neat sketch, the mechanisms obtained by the inversions of four-bar chain.

12. a) In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres is 240 mm and the length of the driving crank is 120 mm. Find the inclination of the slotted bar with the vertical in the extreme position and the time ratio of cutting stroke to the return stroke. If the length of the slotted bar is 450 mm, find the length of the stroke if the line of stroke passes through the extreme positions of the free end of the lever.

(OR)

- b) Locate all the instantaneous centres of the slider crank mechanism. The crank (OA) is 160 mm and the connecting rod (AB) is 470 mm long. If the crank rotates clockwise with an angular velocity of 12 rad/s, Determine 1. Linear velocity of slider (B) 2. Angular velocity of the connecting rod (AB), at a crank angle of  $30^\circ$  from inner dead centre position using instantaneous centre method.

13. a) A symmetrical cam with convex flanks operates a flat-footed follower. The lift is 10 mm, base circle radius 20 mm. The total angle of the cam action is  $162^\circ$ . Find the radius of convex flanks and nose and determine the maximum acceleration and retardation during lift when the cam shaft rotates at 1200 rpm. Period of acceleration is half the period of retardation during the lift.

(OR)

- b) Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to  $60^\circ$  of cam rotation. The valve must remain in the fully open position for  $20^\circ$  of cam rotation. The lift of the valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam.



14. a) A pinion having 24 teeth drives a gear having 60 teeth. The profile of the gears is involute with  $20^\circ$  pressure angle, 10 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio.

(OR)

- b) An epicyclic train of gears is arranged as shown in Fig. 14 (b). How many revolutions does the arm, to which the pinions P are attached, when S makes 300 rpm counter clockwise and A is stationary. The number of teeth on the gears S and A are 30 and 130 respectively.

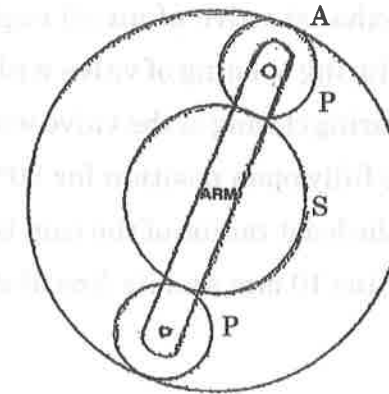


Fig. 14 (b)

15. a) A cross belt running over two pulleys 600 mm and 300 mm diameter connects two parallel shafts 4 meters apart and transmits 7.5 kW from the larger pulley that rotates at 225 rpm. Coefficient of friction between the belt and the pulley is 0.35 and the safe working tension is 25 N per mm width. Determine 1. Minimum width of the belt 2. Initial belt tension and 3. Length of the belt required.

(OR)

- b) An electric motor driven power screw moves a nut in a horizontal plane against a force of 75 kN at a speed of 300 mm/min. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at the screw threads is 0.1. Estimate power of the motor.