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Question Paper Code : 27357

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fourth Semester

Mechanical Engineering

ME 6401 — KINEMATICS OF MACHINERY

(Common to Third Semester Mechanical Engineering (Sandwich),
Mechatronics Engineering)

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Grubler's criteria for a mechanism.
2. Name any two inversions of the 4-bar chain.
3. What is the total number of instantaneous centers that are possible for a mechanism consisting 'n' links?
4. Name the mechanism in which Coriolis component of acceleration is taken into account.
5. Define the following with respect to cam and follower mechanism
 - (a) Pressure angle
 - (b) Pitch circle.
6. State the reasons for providing offset in a cam follower mechanism.
7. State the law of gearing.
8. How is the epicyclic gear train works?
9. Write the mathematical expression for the maximum efficiency of a screw jack.
10. Write mathematical expression for the length of the belt required for two pulleys of diameters d_1 and d_2 and at distance x apart are connected by means of an open belt drive.

PART B — (5 × 16 = 80 marks)

11. (a) Describe with neat sketch, the mechanisms obtained by the inversions of 4-bar chain. (16)

Or

- (b) 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. (16)

12. (a) In a four bar chain ABCD, AD is fixed and is 15 cm long. The crank AB is 4 cm long and rotates at 120 rpm clockwise, while the link CD (whose length is 8 cm) oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°. (16)

Or

- (b) The crank of a slider crank mechanism is 15 cm and the connecting rod is 60 cm long. The crank makes 300 rpm in the clockwise direction. When it has turned 45° from the inner dead centre position, determine (i) acceleration of the mid-point of the connecting rod and (ii) angular acceleration of the connecting rod. (16)

13. (a) Draw the profile of a cam operating a knife-edge follower when the axis of the follower passes through the axis of cam shaft from the following data:
- (i) Follower to move outwards through 40 mm during 60° of cam rotation,
 - (ii) Follower to dwell for the next 45°,
 - (iii) Follower to return to its original position during next 90°,
 - (iv) Follower to dwell for the rest of the cam rotation.

The displacement of the follower is to take place with simple harmonic motion during both the outward and return strokes. The least radius of cam is 50 mm. (16)

Or

- (b) Draw the profile of a cam operating a knife-edge follower (when the axis of the follower passes through the axis of cam shaft) from the following data:
- (i) Follower to move outward through 30 mm with Simple Harmonic motion during 120° of cam rotation,
 - (ii) Follower to dwell for the next 60°,
 - (iii) Follower to return to its original position with uniform velocity during 90° of cam rotation
 - (iv) Follower to dwell for the rest of the cam rotation. The least radius of cam is 20 mm and the cam rotates at 240 rpm. (16)

14. (a) Calculate (i) the length of path of contact, (ii) arc of contact and (iii) the contact ratio when a pinion having 23 teeth drives a gear having teeth 57. The profile of the gears is involute with pressure angle 20° , module 8 mm and addendum equal to one module.

Or

- (b) The arm of an epicyclic gear train rotates at 100 rpm in the anti-clockwise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the centre of wheel A. Find the speed of wheel B. What will be the speed of B, if the wheel A instead of being fixed, makes 200 rpm clockwise. (16)

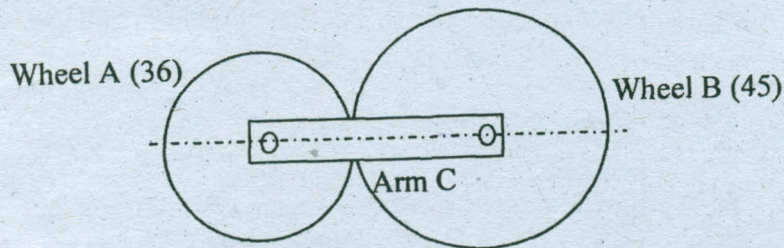


Fig 14(b)

15. (a) The external and internal radii of a friction plate of a single clutch are 120 mm and 60 mm respectively. The total axial thrust with which the friction surfaces are held together is 1500 N. For uniform wear, find the maximum, minimum and average pressure on the contact surfaces. (16)

Or

- (b) Determine the maximum power that can be transmitted using a belt of $100 \text{ mm} \times 10 \text{ mm}$ with an angle of lap of 160° . The density of the belt is 1000 kg/m^3 and the co-efficient of friction may taken as 0.25. The tension in the belt should not exceed 1.5 N/mm^2 . (16)