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10AU/ME44

Fourth Semester B.E. Degree Examination, June/July 2019
Kinematics of Machines

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO full questions from each part.

PART - A

- 1 a. Differentiate giving examples:
 - i) Lower and Higher pairs
 - ii) Closed and unclosed pair
 - iii) Turning and rolling pair. (06 Marks)
- b. What is redundant degree of freedom of a mechanism? Find the degrees of freedom of the mechanism shown in Fig.Q.1(b). (04 Marks)

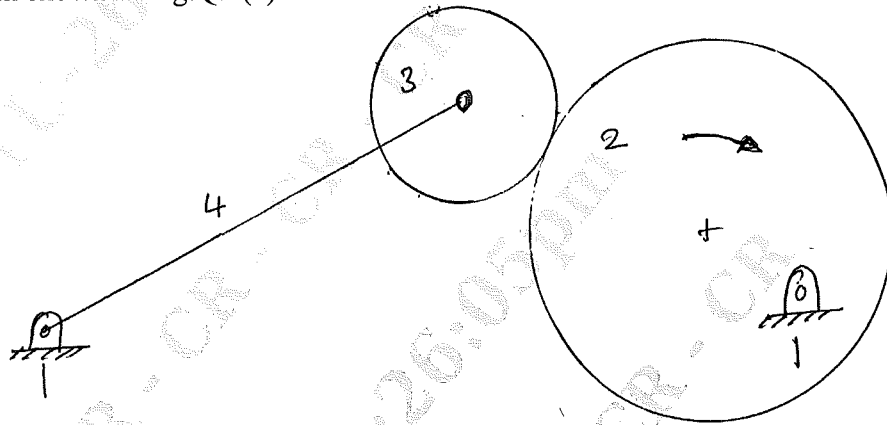


Fig.Q.1(b)

- c. Name the inversions of double slider crank chain. Sketch and explain the working of an elliptical trammel. Prove that it traces an ellipse. (10 Marks)
- 2 a. Derive the condition for a mechanism to trace an exact straight line path. Sketch Peaucellier's mechanism and show that this mechanism satisfies the above condition. (10 Marks)
- b. Sketch and explain:
 - i) Crank and slotted lever quick return motion mechanism.
 - ii) Ratchet and Pawl mechanism. 10 Marks)
- 3 The crank of a slider crank mechanism is 15cm and the connecting rod is 60cm long. The crank makes 300rpm in the clockwise direction. When it has turned 45° from the inner dead centre position, determine:
 - i) Velocity of slider
 - ii) Angular velocity and angular acceleration of connecting rod
 - iii) Linear velocity and acceleration of the mid point of the connecting rod. (20 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 4 a. In a four bar mechanism shown in Fig.Q.4(a) the link 2 is driven at 36 rad/sec. Find the velocity of link 3 and the velocity of point B by Instantaneous center method. Link $O_2A = 50\text{mm}$, $O_4B = AB = 200\text{mm}$, distance $O_2O_4 = 175\text{mm}$. (12 Marks)

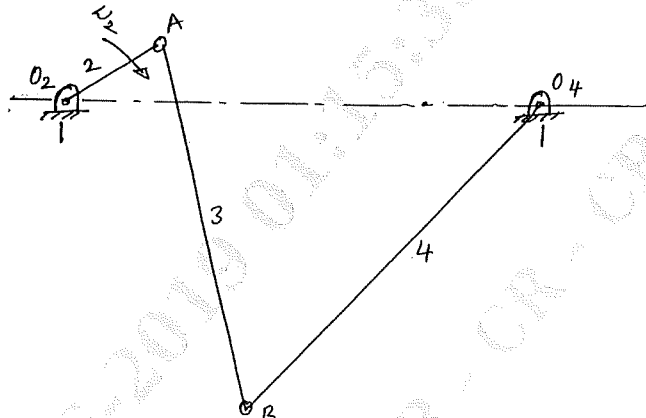


Fig.Q.4(a)

- b. Explain the procedure to make Klein's construction for slider-crank mechanism. (08 Marks)

PART – B

- 5 A four bar chain mechanism ABCD is made up of four links, pin jointed at the ends. AD is a fixed link which is 120mm long. The links AB, BC and CD are 60mm, 80mm and 80mm long respectively. At certain instant, the link AB makes an angle of 60° with the link AD. If the link AB rotates at uniform speed of 10rpm clockwise direction, determine analytically
i) Angular velocity of the links BC and CD ii) Angular acceleration of the links BC and CD. (20 Marks)
- 6 a. Two mating involute gears of 20° pressure angle have a gear ratio of 2.0. The number of teeth on the pinion is 20. The speed of the pinion is 250rpm. Take module as 12mm. If the addendum on each wheel is such that the path of approach and path of recess on each side are of half the maximum possible length each, find:
i) The addendum for pinion and gear
ii) The length of arc of contact
iii) The maximum velocity of sliding during approach and recess. (12 Marks)
- b. Derive expressions for minimum number of teeth required on a gear wheel (involute form) in order to avoid interference. (08 Marks)
- 7 a. Sketch and explain Epicyclic Gear Train. (06 Marks)
- b. Fig.Q.7(b) shows the arrangement of wheels in a compound epicyclic gear train. The sun wheel S_2 is integral with the annular wheel A_1 . The two arms are also integral with each other. The number of teeth on the wheels are as follows:
 $S_1 = 24$, $A_1 = 96$, $S_2 = 30$, $A_2 = 90$
i) If the shaft P rotates at 1,980rpm, find the speed of the shaft Q, when A_2 is fixed.
ii) At what speed does Q rotates, when A_2 instead of being fixed, rotates at 198rpm, in the same direction as S_1 , which is rotating at 1980 rpm?
iii) If the driving torque on shaft P is 300N-m for the case(i), find the torque on shaft Q and the holding torque on A_2 when A_2 is fixed. (14 Marks)

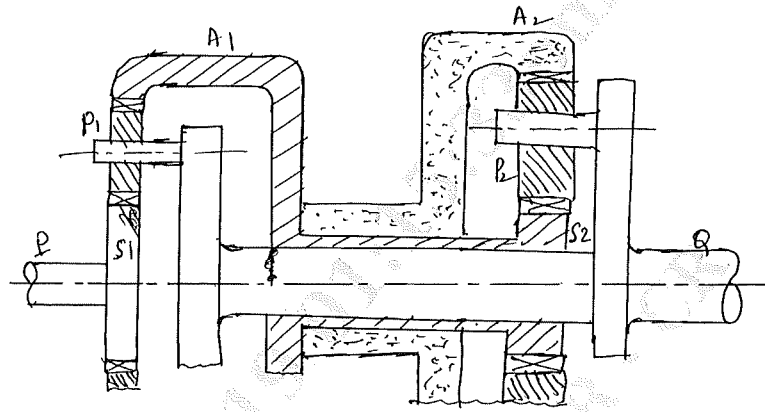


Fig.Q.7(b)

- 8 a. Explain different types of followers with simple sketches. (06 Marks)
- b. From the following data, draw the profile of a cam in which the follower moves with SHM during ascent while it moves with uniformly accelerated and decelerated motion during descent.
- Least radius of the cam = 5cm
 Angle of ascent = 48°
 Angle of dwell between ascent and descent = 42°
 Angle of descent = 60°
 Lift of follower = 4cm
 Diameter of roller = 3cm
 Distance between line of stroke of the follower and vertical centre line of cam = 2cm.
 If the cam rotates at 360rpm, find the maximum velocity and acceleration of the follower during descent. (14 Marks)

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