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18ME44

Fourth Semester B.E. Degree Examination, June/July 2024
Kinematics of Machines

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Distinguish between:
      i) Mechanism and Machine   ii) Higher pair and lower pair **(04 Marks)**
   b. Find the degrees of freedom for the kinematic chains shown in the Fig.Q.1(b). **(08 Marks)**
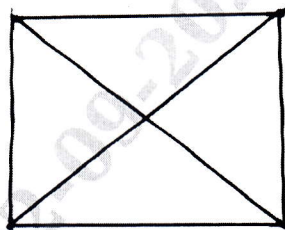

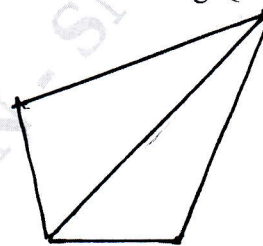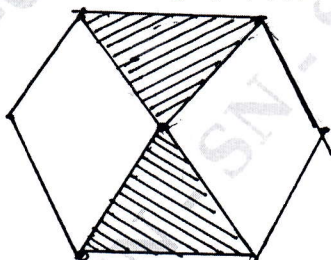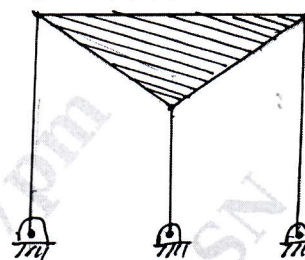Fig.Q.1(b)(i)   Fig.Q.1(b)(ii)

Fig.Q.1(b)(iii)   Fig.Q.1(b)(iv)

   c. Explain inversions of mechanism. With neat sketch explain the inversions of single slider crank mechanism with applications for each inversion. **(08 Marks)**

OR

2 a. Sketch and explain Peaucellier's straight line mechanism and prove that it can trace a straight line. **(10 Marks)**
   b. In a crank and slotted lever quick return mechanism, the driving crank length is 75mm. The distance between the fixed centres is 200mm and the length of the slotted lever is 500mm. Find the ratio of the times taken on the cutting and idle strokes. Determine the effective stroke also. **(10 Marks)**

Module-2

3 A slider crank mechanism has crank AB of 200mm and connecting rod BC of 600mm length. The angular velocity of the crank AB is 30 rad/sec, crank rotates in CW direction. When the crank has turned $30°$ from inner dead center, find the angular acceleration of connecting rod and acceleration of slider C. **(20 Marks)**

OR

4 a. What is Coroli's component of acceleration? Explain with a neat sketch. **(06 Marks)**
   b. In a four bar mechanism ABCD, AD is fixed and crank AB rotates at a uniform speed of 300rpm in anticlockwise direction. Lengths of various links are as follows: AB = 20cm, BC = 30cm, CD = 32cm and AD = 60çm. When the crank AB has turned through $60°$, locate all instantaneous centers and find the angular velocity of link BC. **(14 Marks)**

Module-3

5 In a slider crank mechanism, crank radius is 100mm and connecting rod length is 500mm. The crank rotates in the counter clockwise direction at an angular velocity of 15 rad/sec and angular acceleration of 115rad/sec². Find the acceleration of piston and the angular acceleration of connecting rod when the crank is at 60° from inner dead centre. **(20 Marks)**

OR

6 Derive the Freudenstein's equation for four bar mechanism. Also explain the function generation for four bar mechanism. **(20 Marks)**

Module-4

7 Draw the profile of a cam operating a knife edge follower from the following data:
i) Follower to move outward through a distance of 20mm during 120° of cam rotation.
ii) Dwell for the next 60°.
iii) Return to initial position during next 90°.
iv) Dwell for the remaining 90° of cam rotation.
The cam rotates at 500rpm in clockwise direction. The minimum radius of the cam is 40mm and the line of stroke of the follower is offset 15mm from the axis of the fott cam. Displacement of the follower is to take place with uniform acceleration and retardation motion for both outward and return stroke. Determine the maximum acceleration during outward and return stroke. **(20 Marks)**

OR

8 Draw the profile of a cam operating a roller follower with the following data:
Minimum cam radius = 25mm, Lift = 30mm, Roller diameter = 20mm. The cam lifts the follower for 120° with SHM followed by a dwell of 30°, then the follower lowers down during 150° of the cam rotation with uniform acceleration and deceleration, followed by a dwell period. If cam rotates at a uniform speed of 150rpm in clockwise direction. Find the maximum velocity and acceleration during return stroke. **(20 Marks)**

Module-5

9 a. Derive an expression for the minimum number of teeth on pinion to avoid interference. **(08 Marks)**

b. The following data relate to a pair of 18° involute gears in mesh:
Module = 8mm, Number of teeth on pinion = 15, Number of teeth on gear = 45, Addenda on pinion and gear is 1.1 module. Find:
i) Number of pairs of teeth in contact.
ii) The angle turned by the gear.
iii) Ratio of sliding to rolling motion when the tip of the tooth is just making the contact and is just leaving the contact. **(12 Marks)**

OR

10 a. Explain different types of gear trains. **(08 Marks)**

b. In an epicyclic gear train, an arm carries two gears A and B having 40 and 50 teeth respectively. If the arm rotates at 120rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 250rpm in the clockwise direction, what will be the speed of gear B? **(12 Marks)**

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