Code: 20A03402

R20

B.Tech II Year II Semester (R20) Regular & Supplementary Examinations August/September 2023

KINEMATICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a)	Write the Applications of single slider crank mechanism.	2M
(b)	Explain DOF with the required equation.	2M
(c)	What is the difference between exact and approximate straight line motion?	2M
(d)	Suggest any two examples for exact and approximate straight line motion.	2M
(e)	How tangential and normal components of accelerations for point on a link can be determined?	2M
(f)	What do you understand by the term velocity image of a link?	2M
(g)	Compare the performance of knife-edgeand roller followers.	2M
(h)	State the law of gearing.	2M
(i)	Explain the terms: (i) Module and (ii) Addendum.	2M
(j)	What is the simple harmonic motion?	2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2	(a)	Explain the inversions of a double slider crank chain with a neat sketch.	5M
	(b)	List out the practical applications of inversions.	5M
		OR	
3	(a)	What is a pantograph? Show that it generates a path similar to the path traced by a point on the mechanism.	5M
	(b)	Explain with a neat sketch 4 bar linkage.	5M
4	(a)	With a neat sketch, explain the working of any two types of approximate straight line mechanisms.	5M
	(b)	List out the advantages of universal coupling.	5M
		OR	
5	(a)	With neat sketch, explain the Ackerman steering gear of an automobile.	5M
	(b)	What are the disadvantages of Davis steering gear mechanism?	5M
6	(a)	In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm clockwise, while the link CD = 80 mm and oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°.	5M
	(b)	Explain how the velocities of a slider and the connecting rod are obtained in a slider crank mechanism.	5M
		OR	
7	(a)	What will be the rubbing velocity at pin joint when the two links move in the same and opposite directions?	5M
	(b)	What are the various methods used for finding out acceleration of a mechanism? Explain any one of them.	5M

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8	Explain the classification of gears with neat sketches.	10M
	OR	
9	The number of teeth on each of the two equal spur gears in mesh is 40. The teeth have 20° in volute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, calculate the addendum.	10M
10	A cam is to give the following motion to a knife-edged follower: (i) Outstroke during 60° of cam rotation, (ii) Dwell for the next 30° of cam rotation, (iii) Return stroke during next 60° of cam rotation, and (iv) Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower is offset by 20 mm from the axis of the cam shaft.	10M
	OR	
11	Apply the following data in drawing the profile of a cam in which a knife-edged follower is raised with uniform acceleration and deceleration and is lowered with simple harmonic motion: Least radius of cam = 60 mm, Lift of follower = 42 mm, Angle of ascent = 60°, Angle of dwell between ascent and descent = 40°, Angle of descent = 72°. If the cam rotates at 180 rpm, determine the maximum velocity and acceleration during ascent and descent.	10M

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Code: 20A03402 **R20**

B.Tech II Year II Semester (R20) Regular & Supplementary Examinations April/May 2024

KINEMATICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1		Answer the following: (10 X 02 = 20 Marks)	
	(a)	Define 'Machine' and 'Mechanism'. How are these different from each other?	2M
	(b)	Write down Kutzbach criterion to find the mobility of a planar mechanism.	2M
	(c)	Define Instantaneous center of rotation.	2M
	(d)	What is the Coriolis acceleration component?	2M
	(e)	How do you determine the direction of coriolis component of acceleration?	2M
	(f)	State and prove Kennedy's theorem of instantaneous centers of rotation of three bodies.	2M
	(g)	State Law of Gearing.	2M
	(h)	State the advantages of involute profile as a gear tooth profile.	2M
	(i)	How is the epicyclic gear train works?	2M
	(j)	Enumerate the various types of follower motions used in cam mechanisms.	2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2		Describe the following mechanisms with neat sketches and state on which kinematic chain each one is based: (i) Beam engine, (ii) Whitworth quick return mechanism, (iii) Scott Russel mechanism, (iv) Oldham coupling.	10M
		OR	
3	(a)	Discuss various types of constrained motion.	5M
	(b)	What is Kutzback's criterion for degree of freedom of plane mechanisms? In what way is Grubler's criterion different from it?	5M
4	(a)	Write about Davis Steering gear Mechanism and Ackermanns steering gear Mechanism with suitable sketches.	5M
	(b)	Draw a neat sketch of the Scott Russell's mechanism, and explain its working. How this mechanism can be modified to produce Grasshopper mechanism.	5M
		OR	
5	(a)	Sketch a Paucellier mechanism. Show that it can be used to trace a straight line.	5M
	(b)	Derive an expression for the ratio of angular velocities of the shafts of a Hooke's joint.	5M

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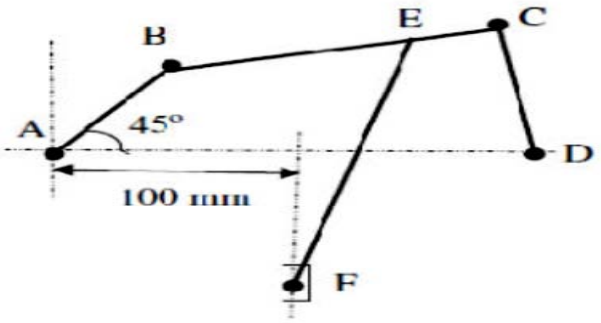
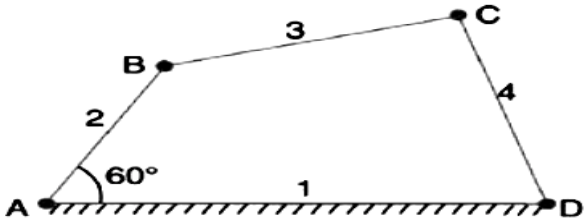
6 The link AB of the mechanism shown in the figure rotates uniformly in a clockwise direction at 200 r.p.m. If the lengths of the links are AB = 60 mm, BC = 160 mm, CD = 100 mm, AD = 200 mm, EF = 200 mm and EC = 40 mm, determine the linear velocity and acceleration of F for the position shown. Also, determine the angular velocity and angular acceleration of EF. 10M



OR

7 (a) Explain the procedure to construct Klein's construction to determine the velocity and acceleration of a slider-crank mechanism. 5M

(b) Locate all the instantaneous centres for a four bar mechanism as shown in figure. The lengths of various links are: AD = 125 mm; AB = 62.5 mm; BC = CD = 75 mm. If the link AB rotates at a uniform speed of 10 rpm in the clockwise direction, find the angular velocity of the links BC and CD. 5M



8 Use the following data in drawing the profile of a cam in which a knife-edged follower is raised with uniform acceleration and deceleration and is lowered with simple harmonic motion: Least radius of cam = 60 mm; Lift of follower = 45 mm; Angle of ascent = 60°; Angle of dwell between ascent and descent = 40° ; Angle of descent = 75° If the cam rotates at 180 rpm, determine the maximum velocity and acceleration during ascent and descent. 10M

OR

9 (a) What is Interference? Derive the relation for the minimum number of teeth for a pair of in volute profile of teeth to avoid interference. 5M

(b) Compare cycloidal and involute gear tooth profile. 5M

10 (a) What is a cam? What type of motion can be transmitted with a cam and follower combination? What are its elements? 5M

(b) A tangent cam with straight working faces tangential to a base circle of 120 mm diameter has a roller follower of 48 mm diameter. The line of stroke of the roller follower passes through the axis of the cam. The nose circle radius of the cam is 12 mm and the angle between the tangential faces of the cam is 90°. If the speed of the cam is 180 rpm, determine the acceleration of the follower when (i) during the lift, the roller just leaves the straight flank, (ii) the roller is at the outer end of its lift, i.e., at the top of the nose. 5M

OR

11 Describe about simple harmonic motion. How would you estimate the uniform velocity, uniform acceleration and retardation in cams? 10M

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