Q. Code:138810

Reg. No. | | | | | | | | | | | | | | |

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth Semester

ME18403 - KINEMATICS OF MACHINERY

(Mechanical Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

CO 1 Students will classify the mechanisms involved in various applications.

CO 2 Students will design the linkage mechanisms for specified output motions.

CO 3 Students will compute the displacement, velocity, and acceleration for any given planar mechanisms.

CO 4 Students will calculate the kinematic parameters of cam and gear mechanisms.

CO 5 Students will calculate the kinematic parameters of cam and gear mechanisms.

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	What is a higher kinematic pair? Whether lead screw in lathe is Higher pair?	**1**	**2**
2.	How many turning pairs are there in a double slider crank chain?	**1**	**2**
3.	In a petrol engine mechanism, the velocity of the piston is maximum when the crank is (a) at the dead centers (b) at right angles to the line of stroke. (c) slightly less than 90° to line of stroke (d) slightly above 90° to line of stroke	**2**	**2**
4.	Explain how the coriolis component of acceleration arises when a point is rotating about some other fixed point and at the same time its distance from the fixed point varies.	**2**	**2**
5.	What is the solution to avoid undercutting in the CAM?	**3**	**2**
6.	Why cycloidal motion is most suitable for high-speed cam follower operations?	**3**	**2**
7.	Differentiate Cycloidal teeth with Involute in terms of interference.	**4**	**2**
8.	Whether double helical gear and Herringbone gear are synonymous or different. Justify.	**4**	**2**
9.	What about slip in new clutch?justify.	**5**	**2**

10. Which type of lever is screw jack? What are 5 uses of screw jack? **5** **2**

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	Determine the mobility (degrees of freedom) of the mechanism shown in Figure 11 (a) and (b) using Kutzbach mobility criterion and classify them.	**(14)**	**1**	**3**

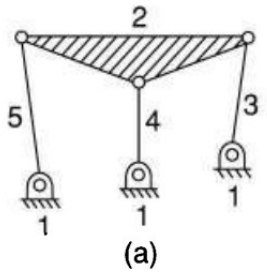

Figure 11a.

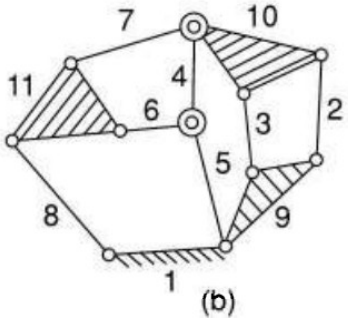

Figure 11b

(OR)

(b)	Sketch double slider mechanism and its various inversions, stating actual machines in which these are used in practice.	**(14)**	**1**	**3**
12. (a)	A mechanism is to be designed to generate the function $Y = X^2$ for the range $2 \leq x \leq 4$, using three precision points. Find the three values of x and y. Assume Θ vary from 40 degree to 120 degree and ϕ vary from 60 degree to 132 degree. Also calculate the link lengths.	**(14)**	**2**	**3**

`(OR)

(b)	In a four bar chain ABCD, link AD is fixed and the crank A B rotates at 10 radians per second clockwise. Lengths of the links are AB = 60 mm; BC = CD = 70 mm; DA = 120 mm. When angle DAB = 60° and both B and C lie on the same side of AD, find 1. angular velocities (magnitude and direction) of BC and CD; and 2. angular acceleration of BC and CD.	**(14)**	**2**	**3**

13. (a)	Construct the profile of a cam to suit the following industrial specifications: Cam shaft diameter is 40 mm; Least radius of cam is 25 mm; Diameter of roller is 25 mm; Angle of lift is 120°; Angle of fall is 150°; Lift of the follower is 40 mm; Number of pauses are two of equal interval between motions. During the lift, the motion is S.H.M. During the fall the motion is uniform velocity. The speed of the cam shaft is uniform.	**(14)**	**3**	**3**
	(OR)			
(b)	Classify the CAMS according to the shape and follower movement, draw neat sketch for each type.	**(14)**	**3**	**3**
14. (a)	A pinion has 24 teeth and drives a gear with 64 teeth. The teeth are of involute type with 20° pressure angle. The addendum and the module are 8 mm and 10 mm respectively. Determine path of contact, arc of contact and the contact ratio.	**(14)**	**4**	**3**
	(OR)			
(b)	Two shafts A and B are co-axial. Gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. Gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to shaft B. Sketch the arrangement and find the number of teeth on internal gear G if all gears have the same module. If shaft A rotates at 110 r.p.m., find the speed of shaft B.	**(14)**	**4**	**3**

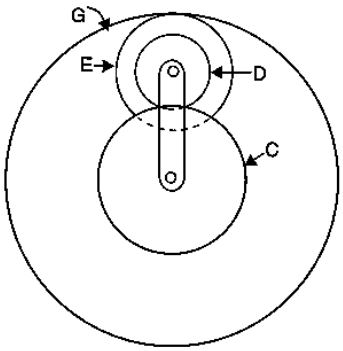

Figure 14b

15. (a)	A bolt with a square threaded screw has mean diameter of 25 mm and a pitch of	**(14)**	**5**	**4**

3 mm. It carries an axial thrust of 10 kN on the bolt head of 25 mm mean radius. If $\mu = 0.12$, find the force required at the end of a spanner 450 mm long, in tightening up the bolt.

(OR)

		Marks	CO	RBT LEVEL
(b)	Determine the maximum, minimum and average pressure in plate clutch when the axial force is 4 kN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume uniform wear.	**(14)**	**5**	**4**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	In a packaging line (schematically represented in the below figure 16), the crank OA rotates at 150 rpm in the clockwise direction, determine the velocity of the slider D.	**(10)**	**5**	**5**

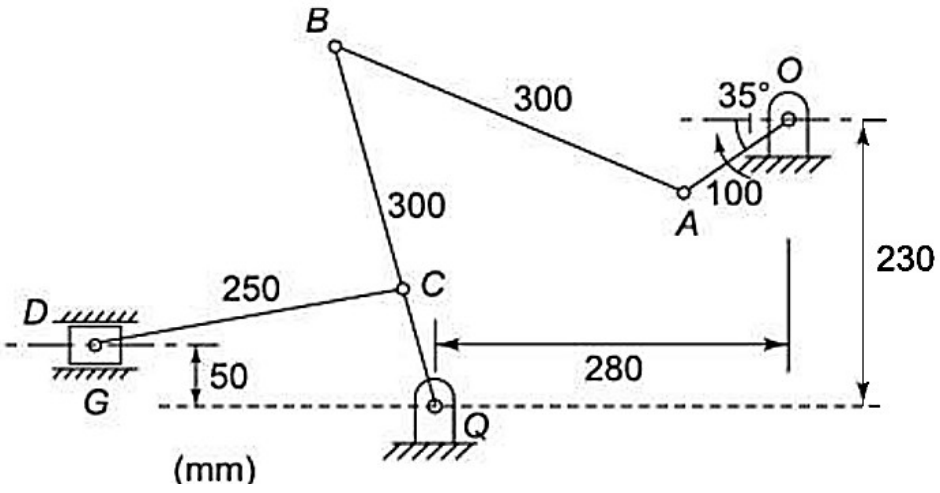

Figure 16