

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lecture-wise Plan

Subject Name: Kinematics & Theory of Machines

Subject Code- MEC408T

Semester: Fourth

Year: 2nd Year

Module Number	Topics	Number of Lectures
1	1. Introduction to mechanisms, Difference between Machine and Mechanism	1L
	Classification of Pairs of Elements, Kinematic chain, types of joints in a chain	1
	Four-bar linkage: motions of links	2
	Grashof's criterion of movability. Degrees of freedom for plane Mechanisms	2
	Gruebler's criterion for plane mechanism, Kinematic inversions – four Inversions of a Slider-Crank Chain.	2
	Velocity analysis in Mechanisms: Relative velocity method – slider crank mechanism,	1
	four bar mechanism, Crank and slotted lever mechanism	1
	; Instantaneous centre method – Kennedy's theorem;	1
	Acceleration analysis: Acceleration Images	2
	, Klein's construction, analytical expression of velocity & acceleration.	2
2	2. Belt-drive – introduction;	2
	Law of belting, Length of flat belt for open and cross belt connections;;	1
	Stepped pulley for open flat belt;	1
	Tension in flat belt and V-belts; Power transmitted in belt drive	2
3	3. Gear terminology, Laws of gearing,	2L
	types of gears – Spur, Bevel, Helical, Worm; tooth profile	1

	, interference; Gear trains – simple, compound,	2
	epicyclic gear train; Speed-torque analysis of gear trains.	2
4	4. Classification of Cams and followers;	2L
	Radial Cam, Analysis of knife-edge, roller and flat face follower motion – constant velocity,.	3
	simple harmonic, constant acceleration & deceleration;	2
	Offset follower	1
5	5. Kinematic Synthesis: Introduction to problems of function generation	2L
	, path generation and rigid body guidance; Type, Number and Dimensional Synthesis;	1
	Two and three position synthesis of four bar mechanism and slider –crank mechanism :	2
	Graphical – pole, Relative pole and Inversion method; Analytical solution -	1
	Freudenstein’s Method.	2
	Study of lower pair Mechanisms- Pantograph	
	, Parallel linkage mechanisms, Straight line mechanism,	1
Automobile steering mechanism, Hooks joint.	1	
Total Number Of Hours = 46		

Assignment No. 1

- 1 Classify kinematic pair based on nature of contact. Give examples.
- 2 When a linkage become mechanism
- 3 Classify the constrained motion
- 4 List the inversion of four bar mechanism?
- 5 Distinguish between kinematics and kinetics?
- 6 Discuss toggle position?

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- 7 Describe of working pantograph and write its application.
- 8 Illustrate the applications of single slider crank mechanism?
- 9 Define kinematics pairs with example
- 10 Discuss Elliptical trammel

11. The Crank of a slider crank mechanisms rotates clockwise at a Constant speed of 300 rpm. The crank is 125 mm and connecting rod is 600 mm long. Determine
 1. Linear velocity and acceleration of the mid Point of the connecting rod, and 2. Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position

12. In a four link mechanism, the dimensions of the links are $AB=200$ mm, $BC=400$ mm, $CD=450$ mm and $AD=600$ mm. At the instant when $\angle DAB=90^\circ$, the link AB has angular velocity of 36 rad/s in the clockwise direction. Determine (i) The velocity of point C, (ii) The velocity of point E on the link BC When $BE =200$ mm (iii) the angular velocities of links BC and CD, iv) acceleration of link of linkBC.

13. The dimensions of the various links of a mechanism, as shown in fig. are as follows: $OA=300$ mm; $AB=1200$; $BC=450$ mm and $CD=450$ mm. if the crank OA rotates at 20 r.p.m. in the anticlockwise direction and gives motion to the sliding blocks B and D, find, for given configuration: (1) Velocity of sliding at B and D, (2) Angular velocity of CD (3) Linear acceleration of D and (4) angular acceleration of CD.

Assignment No. 2

1. Define 'degrees of freedom'
2. Explain transmission angle?
3. Explain transmission angle?
4. Describe Grashof's Law for a four bar mechanism?
5. Define Kutzbach criterion for planar mechanism.
6. Explain Grubler's criterion for spatial mechanism.
7. Compare instantaneous center & instantaneous axis?
8. Illustrate the types of links and define it.

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9. Distinguish between machine and mechanism.
10. Describe spatial mechanism
11. a) Derive the expressions for Velocity and acceleration of piston in reciprocating steam engine mechanism with neat sketch
b). Derive the expression for Coriolis component of acceleration with neat sketch

12. In a slider crank mechanism, the length of the crank and the connecting rod are 100 mm and 400 mm respectively. The crank [position is 45° from IDC, the crank shaft speed is 600 r.p.m. clockwise. Using analytical method Determine (1) Velocity and acceleration of the slider, and (2) Angular velocity and angular acceleration of the connecting rod.

13. Locate all instantaneous centers of the slider crank mechanism; the length of crank OB and Connecting rod AB are 125 mm and 500 mm respectively. The crank speed is 600 rpm clockwise. When the crank has turned 45° from the IDC. Determine (i) velocity of slider 'A' (ii) Angular Velocity of connecting rod 'AB'