

CHAPTER-9**Theory of Machines (Answer Key)****1. Mechanisms And Machines**

1	2	3	4	5	6	7	8	9	10
c	d	a	b	c	d	c	a	b	b
11	12	13	14	15	16	17	18	19	20
b	d	b	b	b	d	c	d	b	b
21	22	23	24	25	26	27			
a	d	b	d	c	a	d			

2. Velocity And Acceleration Analysis

1	2	3	4	5	6	7
d	c	a	c	d	b	a

3. Gears And Gear Trains

1	2	3	4	5	6	7	8	9	10
a	c	c	b,c	c	c	c	d	a	a
11	12	13	14	15	16	17	18	19	20
c	a	b	a	a	a	b	a	a	a,c
21	22	23	24	25	26	27			
a	c	b	a	c	d	c			

4. Dynamic Force Analysis And Flywheel

1	2	3	4	5	6	7	8
d	b	d	b	b	a	b	b

5. Balancing

1	2	3	4	5
d	b	b	b	a

6. Cams

1	2	3
a	b	a

7. Governors

1	2	3	4	5	6	7	8	9	10
b	c	c	d	d	d	b	d	c	a
11	12	13							
a	a	b							

8. Vibration

1	2	3	4	5	6	7
d	b	c	a	d	a	d

SOLUTIONS

1. Mechanisms & Machines

1. (c)
Kinematic pair having two, elements which have relative motion between them, is called as kinematic pair.
2. (d)
A mechanism which has four links, called as simple mechanism. Example – four bar mechanism
3. (a)
Universal joint is also known as Hooke's joint. It is used to transmit the power between two non – parallel and non – coaxial but intersecting shaft. It is a lower pair

Applications:

- (1) Power transmission from gear box to differential gear of back axle of auto mobile.
 - (2) Power transmission to different spindles of multiple drilling machine.
 - (3) Knee joint in milling machine
4. (b)
For a kinematic chain, the following relationship is valid-

$$\boxed{L = 2P - 4}$$

L = No. of links

P = No. of lower pairs

Note: It is valid for lower pairs only, no higher pair should exists in the kinematic chain.

5. (c)
A ball and socket joint forms a spherical pair because it is assembled in spherical form.
- (d)
For complete formation of kinematic chain, minimum four links are required. Because in kinematic chain, the last link is attached to the first link.

6. (c)
For a kinematic chain, the following relationship is valid.

$$\boxed{L = 2P - 4}$$

L = No. of links

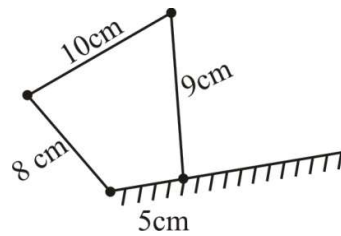
P = No. of lower pairs

Note: – It is valid for lower pairs only, no higher pair should exist2 in the kinematic chain.

7. (a)
Crank shaft turns into the journal bearing, so it forms a turning pair.

8. (b)
According to Grashof's law:

$$\boxed{(l+s) < (p+q)}$$
 = for the formation of complete revolution of a link.



where, l = longest link
 s = shortest link
 p, q = remaining two links

Note:–

(A) If it is valid and shortest link is fixed then we get double – crank mechanism.

(B) If it is valid and adjacent to shortest link is fixed then we get crank rocker mechanism

(C) If it is valid and opposite link to shortest link is fixed then we get double rocker mechanism but coupler has complete revolution.

9. (b)

The contact between cam and follower is point contact. So it forms a higher pair.

Note:

Point contact – higher pair

Surface contact – lower pair

10. (b)

The inversions of single slider crank mechanism are following-

A – Whitworth mechanism

B – Gnome engine

C – Crank and slotted lever Quick return motion mechanism

D – Oscillating cylinder engine

E – Hand pump/bull engine/ pendulum pump

11. (d)

The inversions of single slider crank mechanism are following-

A – Whitworth mechanism

B – Gnome engine

C – Crank and slotted lever Quick return motion mechanism

D – Oscillating cylinder engine

E – Hand pump/bull engine/ pendulum pump

12. (b)

The inversions of double slider crank mechanism are following-

A – Elliptical trammel

B – Scotch-yoke mechanism

C – Oldham's coupling

13. (b)

Elliptical trammel is the inversion of double slider crank mechanism and it is used to draw the ellipse.

Any point on it, will trace the ellipse.

14. (b)

A double slider mechanism consists two sliding pairs and two turning pairs.