**UNIT I**

1. Define Kinematic link and Kinematic Pair

It is a resistive body which go to make a part of a machine having relative

motion between them.

When two links are in contact with each other it is known as a pair.If the pair

makes constrain motion it is known as kinematic pair.

1. Define Kinematic chain.

When a number of links connected in space make relative motion of any point on

a link with respect to any other point on the other link follow a definite law it is known as

kinematic chain.

3) Define ‘degrees of freedom’.

It is defined as the number of input parameters which must be controlled independently in order to bring the device into a particular position.

The degrees of freedom of a mechanism (n) is given by

n = 3(L-1)-2j-h

L = Number of links

j = Number of joints

h = Number of higher pairs.

1. What is meant by spatial mechanism?

Spatial mechanism have special geometric characteristics in that all revolute axes are parallel and perpendicular to the plane of motion and all prism axes lie in the plane of motion.

5) Classify the constrained motion.

There are three types.

1. Completely constrained motion (eg. Square bar moving in a square hole)
2. In completely constrained motion ( eg. Circular shaft in a hole)
3. Successfully constrained motion (eg. Piston and cylinder)

6) What are the some important inversions of four chain mechanism?

1) Crank-rocker mechanism.

2) Crank-crank mechanism.

3) Rocker-rocker mechanism.

7) What is toggle position?

It is the position of a mechanism at which the mechanical advantage is infinite and the sine of angle between the coupler and driving link is zero.

8) What is pantograph?

Pantograph is a device which is used to reproduce a displacement exactly in an enlarged or reduced scale. It is used in drawing offices, for duplicating the drawings, maps, plans, etc. It works on the principle of 4 bar chain mechanism.

9) What are the applications of single slider crank mechanism?

1) Rotary or Grome engines.

2) Crank and slotted lever mechanism.

3) Oscillating cylinder engine.

4) Bull engine

5) Hand pump.

10) Give some examples for kinematics pairs.

1) Crank and connecting rod

2) Connecting and piston rod

3) Piston and engine cylinder.

11) Discuss Elliptical trammel

Elliptical trammel is an instrument used for drawing ellipses. It is the best example for first inversion of double slider crank chain.

12) What is movability?

It includes the 6 degree of freedom of the device as a whole, as though the ground link were not fixed, ad this applies to a kinematic chain.

13) What is mobility?

It neglects these and considers only the internal relative motions, thus applying a mechanism.

14) What is meant by transmission angle?

In a four bar chain mechanism the angle between the coupler and the follower link is called as the transmission angle.

15) What is meant by Ackermann steering?

Ackermann steering is the one of the mechanism used in vehicles. It is obtained by inversion of four bar chain.

16) Define Grashoff’s law.

Sum of shortest link length and sum of longest link length is not greater than the

sum of remaining link length.

17) List out few types of rocking mechanism?

Pendulum motion is called rocking mechanism.

1.Quick return motion mechanism.

2.Crank and rocker mechanism.

3.Cam and follower mechanism.

18) What are the different types of links?

1) Rigid link.

2) Flexible link.

3) Fluid link.

19) Define double slider crank chain mechanism?

A kinematic chain which consist of two turning pair and two sliding pair is

known as double slider crank mechanism.

20) What is the use of oldham’s coupling?

It is used for transmitting motion between two shafts which are parallel but not coaxial.

21) What is link?

A link or an element is defined as that part of a machine which has motion relative to some other part. A link need not to be a single unit, but it may consist of several parts which are manufactured as separate units.

22) What is meant by motion adjustment mechanism?

The mechanism used to adjust or modify the motion of the link are known as motion adjustment mechanism. Motion adjustment is obtained by wedges, levers and rack and pinion.

**UNIT II**

1. What is kinematic analysis?

The objective of the kinematics analysis is to determine the kinematic quantities such as displacements, velocities and accelerations of the elements in a mechanism.

2. What is displacement?

It is defined as the distance moved by a body with respect to a certain fixed point.

3. What is vector?

A vector is a straight line of a certain length possessing a starting point and a terminal point at which it carries an arrow head.

4. Write down the different types of motion.

1) Rectilinear motion.

2) Curvilinear motion.

3) Circular motion.

5. What is Rectilinear motion?

In this motion, the particles of a body move in straight parallel paths. Such a motion is also known as Translatory motion or straight line motion.

6. What is Curvilinear motion?

In this motion, the particles of a body move along parallel circular arcs or curved paths.

7. What is Circular motion?

When all the particles of a body travel in concentric circles then the motion is said to be circular motion.

8. What are the components of acceleration?

i) Radial component of acceleration

ii Tangential component of acceleration

9. Define instantaneous center axis?

Instantaneous axis is a line drawn through an instantaneous center and perpendicular to the plane of motion.

10. Write any two rules to locate Instantaneous center?

a) When two links are connected by a pin joint the instantaneous center lies on the center of the pin.

b) When two links have a sliding contact,the instantaneous center ies at infinity in a direction perpendicular to the path of motion of slide.

11. What is the difference between velocity and speed?

Velocity is defined as the rate of change of displacement of a body with respect to the time.

Speed is defined as the rate of change of linear displacement of a body with respect to the time.

12. What are the different methods are used for finding the velocity?

1) Graphical method.

2) Analytical method.

13. Write the different types of graphical method.

1) Relative velocity method.

2) Instantaneous centre method.

14. Define Kennedy’s theorem.

The Kennedy’s theorem states that if three bodies move relatively to each other, they have three instantaneous centres and lie on a straight line.

15. What are properties of instantaneous centre?

1) A rigid link rotates instantaneously relative to another link at the instantaneous centre for the configurations of the mechanism.

2) The two rigid links have no linear velocity relative to each other at the instantaneous centre. At this point the two rigid links have the same linear velocity relative to the rigid link.

16. Explain any two methods of reducing interference in gears.

1. The height of the teeth may be reduced.

2. The pressure angle may be increased.

3. The face of gear tooth may be relieved.

17. Explain any two methods of reducing interference in gears.

1. The height of the teeth may be reduced.

2. The pressure angle may be increased.

3. The face of gear tooth may be relieved.

18. What is angular velocity ratio theorem?

The angular velocity ratio theorem states that the angular velocity ratio of any two bodies in planar relative to a third body is inversely proportional to the segments into which the common instantaneous centre cuts the line of centres.

19. Define rubbing velocity.

The algebraic sum between the angular velocities of the two links which are connected by pin joints, multiplied by the radius of the pin.

**UNIT III**

1. What is a cam?

A cam is a rotating machine element which gives reciprocating or oscillating motion to another element known as follower.

2. Give some examples of cam.

1) Radial or disc cams.

2) Cylindrical or barrel cams.

3) End or face cams.

4) Wedge cams.

3. Define tangent cam.

When the flanks of the cam are straight and tangential to the base circle and nose circle the cam is known as tangent cam.

4. What ate the different motions of the follower?

1) Uniform motion.

2) Simple harmonic motion.

3) Uniform acceleration and retardation.

4) Cycloidal motion.

5. Explain radial follower.

When the motion of the follower is along an axis passing through the centre of the cam, it is known as radial follower.

6. Define contact ratio.

Contact ratio is defined as the ratio of the length of arc of contact to the circular pitch mathematically.

Contact ratio = length of arc of contact

Pc

Where Pc = circular path.

7.Define angle of ascend?

The angle of rotation of the cam from the position when the follower begins to rise till it reaches its highest points. It is denoted by θ

8.Define angle of descend?

The angle through which the cam rotates during the time the follower returns to the initial position. It is denoted by θr.

9.Define angle of dwell?

It is the angle through which the cam rotates while the follower remains stationary at the highest or the lowest.

10 . Define trace point.

It is a reference point on the follower and is used to generate the pitch curve. In case of knife edge follower the knife edge represents the trace point and the pitch curve corresponds to the cam profile.

11. Define lift or stroke in cam.

It is the maximum travel of the follower from its lowest position to the topmost position.

12. What do you know about nomogram?

In nomogram, by knowing the values of total lift of the follower and the cam rotation angle for each segment of the displacement diagram, we can read directly the maximum pressure angle occurring in the segment for a particular choice of prime circle radius.

13. Write the different types of follower.

1) Knife edge follower

2) Roller follower

3) Mushroom or flat faced follower

4) Spherical faced or curved shoe follower.

14. What is cam profile?

The surface of cam which comes into contact with follower, is known as cam profile.

15. What is base circle?

It is the smallest circle that can be drawn to the cam profile. The radius of the base circle is called the least radius of the cam.

16. What is pitch curve?

The locus or path of the tracing point is known as the pitch curve. For the purpose of laying out the cam profiles, it is assumed that the cam is fixed and the follower rotates around it.

17. What is prime circle?

The smallest circle drawn tangent to the pitch curve is known as prime circle.

18. What is pressure angle?

It is the angle between the direction of the follower motion and a normal to the pitch curve. This angle is very important in cam design as it represents steepness of the cam profile.

19. What is pitch point?

It is the point on the pitch curve at which the pressure angle is maximum.

20. What is pitch circle?

It is the circle passing through the pitch point and concentric with the base circle.

21. What is cam angle?

It is the angle of rotation of the cam for a definite displacement of the follower.

22. Define Spherical faced follower.

When the contacting end of the follower is a spherical shape, it is called spherical faced follower.

23. Define Mushroom follower.

When the contacting end of the follower is a perfectly flat face , it is called flat-faced follower.

When the flat faced follower is circular it is called mushroom follower.

**UNIT IV**

1. What are the advantages and disadvantages of gear drives?

Advantages:

a) It transmits exact velocity ratio.

b) It has high efficiency.

Disadvantages:

1. The manufacture of gears requires special tool and equipment.
2. The error in cutting teeth may cause vibrations and noise during operation.
3. Define module of gears and its relation to circular pitch.

It is the ratio of the pitch circle diameter in millimeters to the number of teeth. It is usually denoted by *m*.

Mathematically,

Module, *m* = *D* /*T*

1. Define addendum and dedendum.

Addendum is the radial distance of a tooth from the pitch circle to the top of the tooth.

Dedendum is the radial distance of a tooth from the pitch circle to the bottom of the tooth.

1. Define Pressure angle with respect to Cam.

It is the angle between the direction of the follower motion and a normal to the pitch curve. This angle is very important in designing a cam profile. If the pressure angle is too large, a reciprocating follower will jam in its bearings.

1. Define Clearance.

The amount by which the dedendum of a gear exceeds the addendum of the mating gear is called clearance.

1. Define bevel gears.

The gears which are used to connect shafts whose axes of rotation intersect with each other are called bevel gears.

1. Define Pressure angle with respect to gears

It is the angle between the common normal to two gear teeth at the point of contact and the common tangent at the pitch point.

The standard pressure angles are 14 .5° and 20°.

1. Define epicyclic gear train.

In a gear train when the axes of shafts over which the gears are mounted, rotates or moves relative to a fixed axis is called epicyclic gear train.

1. Define velocity ratio.

Velocity ratio of a simple gear train is defined as the ratio of the angular velocity of the first gear in the train to the angular velocity of the last gear.

1. Define gear train.

A combination of gears that is used for transmitting motion from one shaft to another shaft is known as gear train.

E.g. spur gear, spiral gear.

1. Define gear ratio.

The quotient of the number of teeth on the wheel divided by the number of threads on the worm.

1. Define helix angle (β).

It is the angle between the line drawn through one of the teeth and the center line of the shaft on which the gear is maintained.

1. Define Spur gear and mitre gear.

* A spur gear is a cylindrical gear whose tooth traces are straight line generation of the reference cylinder. They are used to transmit rotary motion between parallel shafts
* When equal bevel gears (having equal teeth) connect two shafts whose axes are mutually perpendicular, then the bevel gears are known as *mitres*.

1. Write the detail classification of gears.
2. According to the position of axes of the shafts.

The axes of the two shafts between which the motion is to be transmitted, may be

(a) Parallel,

(b) Intersecting, and

(c) Non-intersecting and non-parallel.

2. According to the peripheral velocity of the gears.

The gears, according to the peripheral velocity of the gears may be classified as :

(a) Low velocity,

(b) Medium velocity, and

(c) High velocity.

15. What is an angle of obliquity in gear?

It is the angle between the common normal to two gear teeth at the point of contact and the common tangent at the pitch point. It is also called as pressure angle.

16. What is bevel gearing? Mention its types.

When the non-parallel or intersecting but coplanar shafts connected by gears, they are called bevel gears and the arrangement is bevel gearing.

Types.

1. Skew bevel gearing
2. Spiral gearing.

17. What is meant by arc of approach?

It is the portion of the path of contact from the beginning of the engagement to the pitch point.

18. What is meant by arc of recess?

It is the position of the path of contact from pitch point to the end of the engagement to the pitch point.

19. What is meant by Arc of contact?

It is the path traced by a point on the pitch circle from the beginning to the end of engagement of a pair of teeth.

20. State law of gearing.

The law of gearing states that for obtaining a constant velocity ratio, at any instant of teeth the common normal at each point of contact should always pass through a pitch point, situated on the line joining the centre of rotation of the pair of mating gears.

21. What are the methods to avoid interference?

1. The height of the teeth may be reduced.

2. The pressure angle may be increased.

3. The radial flank of the pinion may be cut back.

22. What do you know about tumbler gear?

Tumbler gears are those which are used in lathes for reversing the direction of rotation of driven gears.

23. Define contact ratio.

It is the ratio of the length of arc of contact to the circular pitch is known as contact ratio. The value gives the number of pairs of teeth in contact.

24. Define cycloidel tooth profile and involute tooth profile.

A cycloid is the curve traced by a point on the circumference of a circle which rolls without slipping on a fixed straight line.

Involute profile is defined as the locus of a point on a straight line which rolls without slipping on the circumference of a circle.

25. Define Backlash.

It is the difference between the tooth space and the tooth thickness along the pitch circle.

Backlash = Tooth space – Tooth thickness.

26. What are the types of gear trains?

1. Simple gear train.

2. Compound gear train.

3. Reverted gear train.

4. Epicyclic gear train.

**UNIT V**

1. Define clutch.

Clutch is a transmission device of an automobile which is used to engage and disengage the power from the engine to the rest of the system.

2. What are the types of friction clutches?

Types of friction clutches are:

\*Disc or plate clutches.

\*Cone clutches.

\*Centrifugal clutches.

3. What is dry friction?

The friction that exists between two unlubricated surfaces is known as dry friction.

4. What is greasy friction?

When the two surfaces in contact have a minute thin layer of lubricant between them, then it is called as greasy friction.

5. What is fluid friction?

When the two surfaces in contact are completely separated by a lubricant, then it is called as fluid friction.

6. What are the types of flat drives?

The types of flat drives are:

\*Compound belt drive.

\*Stepped or cone pulley drive.

\*Fast and loose pulley.

7. State the laws of dry friction.

1. The frictional force is directly proportional to the normal reaction between the surfaces.

2. The frictional force opposes the motion.

3. The frictional force is independent of the area and the shape of the contacting surfaces.

8. State the laws of fluid friction.

1. The frictional force is almost independent of load.

2. The frictional force is independent of the substances of the bearing surfaces and opposing tendency is less.

3. The frictional force reduces with increase in temperature of the lubricant.

9. What is angle of repose?

The angle of repose is defined as the maximum inclination of a plane at which a body remains in equilibrium over the inclined plane by the assistance of friction only.

10. Define Co-efficient of friction.

It is defined as the ratio of the limiting friction to the normal reaction between two bodies.

μ = F / Rn

11. Define slip.

Slip is defined as the relative motion between the belt and pulley.

12. Define law of belting.

Law of belting states that the centre line of the belt, as if approaches the pulley lie

in a plane perpendicular to the axis of that pulley or must lie in the plane of the pulley

otherwise the belt will run off the pulley.

13. Why self locking screws have lesser efficiency?

Self locking screws needs some friction on the thread surface of the screw and nut hence it needs higher effort to lift a body and hence automatically the efficiency decreases.

14. What are the functions of clutches?

1. It supplies power to the transmission system.

2. It stops the vehicle by disconnecting the engine from transmission system.

3. It is used to change the gear and idling the engine.

4. It gives gradual increment of speed to the wheels.

15.What is the difference between cone clutch and centrifugal clutch?

Cone clutch works on the principle of friction alone. But centrifugal clutch uses principle of centrifugal force in addition with it.

16. Why friction is called as necessary evil?

Friction is the important factor in engineering and physical applications such as belt and ropes, jibs, clutches and brakes, so it is the necessary one.

If the friction exceeds certain value it will cause heat, damage and wear when applied. So it is called necessary evil.

17. Define the velocity ratio of the belt drive.

The velocity ratio of the belt drive is defined as the ratio between the velocities of

the driver and the follower or the driven.

18. What is the advantages and dis advantages of V-belt?

Advantages

\*Power transmitted is more due to wedging action in the grooved pulleys.

\*V-belt is more compact, quite and shock absorbing.

\*The V-belt drive is positive because of negligible slip between the belt and the groove.

\*High velocity ratio may be obtained.

Disadvantages of V-belt.

\*It cannot be used with large center distances.

\*It is not as durable as flat belt.

\*It is a costlier system.

19. Define screw jack.

The screw jack is the device used to lift the heavy loads by applying a

comparatively small effort at its handle. The working principle of screw jack is similar to

that of an inclined plane.

19. What is creep?

The phenomenon of sudden contraction and expansions of belt when it passes from slack side to tight side is called as creep.

20. What is centrifugal effect on belts?

During operation, as the belt passes over a pulley the centrifugal effect due to its self weight to lift the belt from the pulley surface. This reduces the normal reaction and hence the frictional resistance.

21. What is wipping?

If the centre distance between two pulleys are too long then the belt begins to vibrate in a direction perpendicular to the direction of motion of belt. This phenomenon is called wipping. It can be avoided by idler pulleys.

22. What is brake?

Brake is a device by means of which motion of a body is retarded for slowing down or to bring it to rest which works on the principle of frictional force, it acts against the driving force.

23. Explain self energizing.

When moments of efforts applied on the break drum and frictional force are in the same direction, the breaking torque becomes maximum. In such a case the brake is said to be partially self actuating or self energizing.