UNIT V CLUTCHES AND BRAKES

1) What is the meant by positive clutch?

A clutch which transmits power from the driving shaft to the driven shaft by means of jaws or teeth is called positive clutch. jaw clutch are superior to friction clutches in that they ensure exact contact (without slipping) ,produce equality in angular velocities of the connected shafts.

2) Why cone clutches better than disc clutches?

Since cone discs are having large frictional areas and wedging action, they can transmit a larger torque than disc clutches with same outside diameter and actuating force and hence cone clutches are preferred to disc clutches .but usually cone clutches are mainly used in low peripheral speed applications .

3) Give the essential three elements in internal shoe rim clutch.

It consist essentially of three elements

- \checkmark The mating frictional surface.
- \checkmark The means of transmitting the torque to and from the surface.
- \checkmark The actuating mechanism

4) How clutches are classified?

Clutches are classified into

- ✓ Expanding-ring
- ✓ Centrifugal
- ✓ Magnetic
- ✓ Hydraulic
- ✓ Pneumatic

5) Define expanding ring clutch.

The expanding ring clutch is often used in textile machinery, escalators and machine tools where the clutch may be located within the driving pulley. Expanding ring clutches benefit from centrifugal effects .Transmits high torque, even at low speed and require both positive engagements and sample release force.

6) Define centrifugal force.

The centrifugal clutch is used mostly for automatic operation .if no spring is used the torque transmitted is proportional to the square of the speed .this is particularly useful for electric motor drives where during starting the driven machine comes up o speed without shock.

7) What are the functions of friction clutch?

The flow of mechanical power is controlled by means of clutch. The clutch is a mechanical device which is used to connect or disconnect the source of power from the remaining parts of power transmission system at the will of the operator.

8) What are the different characteristics of clutch?

The different characteristics of clutch are

- They do not slip
- No heat is generated
- They cannot be engaged at high speeds
- Sometimes they cannot be engaged when both shafts are at rest
- Engagement at any speed is accompanied by shock

9) Classify clutches based on the coupling methods (NOV 2004)

Based on the coupling methods, clutches are classified as follows.

- Positive
- Over running
- Friction
- Magnetic
- Fluid coupling

10) What is the difference between a coupling and clutch? (APR.2004)

Clutch is the coupling that permits the smooth connection and disconnection of two shafts during rotation at the operators will. Coupling is the rigid connection between two shafts for power transmission.

11) Distinguish difference between a wet and dry operation of clutches (APR.2004)

Dry clutch: Friction and torque capacity are high ,but heat dissipation is more difficult .

Wet clutch To dissipate the heat, a lubricant is provided .this reduces the μ and torque carrying capacity.

12) Name four materials used for lining of friction surfaces in clutches (APR.2005)

The four materials used for lining of friction surface in clutches are,

- ✓ Organic materials like leather, wood, cork or felt in conjugation with cast iron, steel or brass.
- ✓ Metals like nodular iron, stainless steel,monel metal and aluminium
- \checkmark Materials like asbestos, moulded or woven with metal chips of brass or copper.
- 13) Define brakes.

A brake is defined as a mechanical device which is used to absorb the energy possessed by a moving system or mechanism by means of friction .the primary purpose of the brake is to slow down or completely stop the motion of a moving system ,such as a rotating drum, machine or vehicle.

14) List out five important characteristics of the brake lining.

The five important characteristics of the brake lining are,

- ✓ High coefficient of frictionLow wear rate High heat resistance ,high heat dissipation capacity
- ✓ Adequate mechanical strength

15) What are the materials used for brake lining?

Cast iron on cast iron ,bronze on cast iron ,steel on cast iron ,wood on cast iron are the materials used for brake lining.

16) List the classification of the mechanical brake.

The mechanical brake are classified as follows

Block brake Internal/external shoe brake Disc brake Band brake 17) Define braking torque.

The braking torque depends upon the amount of energy absorbed by the brake. That is a mechanism system of mass m moving with velocity v_1 is allowed down to velocity v_2 .

18) Define internal expanding brake.

It consists of a shoe which is pivoted at one end and subjected to an acting force p at the other end .a friction lining is fixed on the shoe and the complete assembly of shoe lining and pivot is placed inside the brake system.

19) What is fade? (NOV2004)

The coefficient of friction gradually rises, reaches a peak value and falls rapidly as drum temperature is increased. This rapid fall is known as fade

20) Explain the desirable properties of friction material used for the lining of brake shoes (APR.2004)

Desirable properties of friction material,

Should have high coefficient of friction Should retain braking capacity at temperature up to 300 Celsius Should have high heat conductivity

21. Why in automobile, braking action when travelling in reverse is not as effective as when moving forward? (Apr.2004)

If the movement due to friction force aids the application of brake, the brake is known as self-energizing. If the direction of rotation of the drum is reversed, friction force would oppose the application of brake. That's why braking action when travelling in reverse is not as effective as moving forward.

22. Why should the temperature rise be kept within the permissible range in brakes? (Apr.2004) or define thermal considerations of a brake.

The energy absorbed by the brake is converted into heat, which increases the temperature at the rubbing surfaces, when the temperature increases the co-efficient of friction decreases adversely affecting the torque capacity of the brake. So the temperature rise should be kept within the permissible range in brake.

23. Define cone clutches?

A cone clutch consists of inner and outer conical working surface. The outer cone is keyed to the driving shaft while the inner cone is free to slide axially on the driven shaft due to splines.

24. What are the desirable properties of friction material to be used for clutches (Dec 2005)?

The desirable properties of friction of material to be used for clutches are;

a) A high and uniform co-efficient of friction. b) The ability to withstand high temperatures together with good heat conductivity.c) Good resiliency.

d) High resistance to wear, scoring and galling.

e) Resistance against environmental conditions such as moisture , salt water and fungi.

f) Adequate mechanical and thermal strengths.

25. What is meant by a self-energizing brake?

When the moment of applied force (f.I) and the moment of the frictional force (Ψ, R_n, C) are in the same direction, the frictional force helps in applying the brake. This type of brakes is known as self engineering brake.

26. What is a cam?

Cam is a mechanical member having miscellaneous contour surface which transmit a desired motion to follower by direct contact. With help of cam, it is very easy, accurate and efficient to produce a motion with required velocity and acceleration.

27. Why are cam mechanisms preferred?

The cam mechanisms are preferred over other types because the use of cam makes it possible to obtain an unlimited variety of motions and the cams perform satisfactorily year after year. The mechanical movements from cams are not readily obtained by other types of mechanisms.

28. Define the following terms of a cam: a) Trace point b) Stroke

Trace point - This is a reference point on the follower which is used in the laying out the theoretical curve or pitch curve of the cam.

Stroke -This is the maximum movement of the follower away from the cam shaft from its initial position. This also known rise or lift or threw of the cam.

29. Define the following:a) Pitch point b) Jerk

Pitch point It is the point on the cam pitch curve having the highest pressure angle.

Jerk or pulse The instantaneous time rate of change of acceleration is called as jerk or pulse (i.e., sudden changes in follower acceleration.)

30. What are the fundamental laws of a cam design?

Any cam design for operation at other than very low speed must be designed with following consideration:

a) The cam function must continuous through the first and second derivatives of displacement across the entire interval of 360^{0} .

b) The jerk function must be finite across the entire interval of 360° (i.e., the displacement, velocity and acceleration functions must have no discontinuity in them.)

31. What is meant by plate cam and cylindrical cam?

Plate cams - Cam are in the forms of plates with its edges having desired contour.

Cylindrical cams - Cams are cylindrical in shape having a groove cut along the cylindrical surface to direct the movement of the follower.

32. What is meant by displacement diagram?

Displacement diagram is a graphical representation of series follower displacement during rotation of the cam through one cycle of input motion. In such diagram, the abscissa represents one cycle of input motion (one revolution) and the ordinate represents the follower travel.

33. Compare flat, knife and roller follower.

Knife-edge follower is subjected to excessive wear due to sliding motion. If the load on the follower is small, this follower can be used. The roller follower has rolling contact, so wear is less. The roller and knife-edge follower guides are subjected to side thrust. The flat-faced follower as no side thrust.

34. What are the parameters influenced the cam size?

The cam size depends upon, a) Pressure angle b) Curvature of the cam profile and c) Diameter of the cam shaft.

For same pressure angle, the cam size depends on the type of follower motion.

35. What are the commonly used cam-follower motions?

The commonly used cam-follower motions are

- a) Constant velocity motion
- b) Simple harmonic motion
- c) Double harmonic motion
- d) Parabolic motion.
- e) Cycloidal motion
- f) Cubic curve motion, etc...

36. Why is the uniform velocity follower motion not suitable for high speed cams?

In a high speed cam mechanism, the uniform velocity follower motion generates undesirable forces and vibrations. So it is not suitable for high speed cams.

37. What is the advantage of having parabolic motion for follower over harmonic motion?

Parabolic motion for follower is advantageous over simple harmonic motion because at high speed, the SHM has vibratory disturbances at the beginning and end of the stroke due to sudden inertia forces.

38. Which type of follower motion is best and why?

The cycloidal motion of the follower provides the best possible follower motion for high speed operations. Because the acceleration curve is a sine curve and it became adrupt only if the curve is adjacent to dwell period. Even the adruptness is not severe compare to other type of motions.

39. What is pressure angle of a cam?

It is the angle between normal to cam profile and line of action of cam follower at the point of contact. The pressure angle represents steepness of the cam profile. The pressure angle is limited to 30^{0} for smooth follower action.

40. What is the importance of pressure angle in cam design?

The size of the angle is important because,

- a) Increasing pressure angle increases the side thrust and this increase the forces exerted on cam and follower
- b) If the pressure angle is too large, jamming of follower takes place.
- c) Reducing the pressure angle increases the cam size.

41. What is the maximum limit of pressure angle?

The general, the maximum pressure angle should be 30^0 or less for a translating roller follower and 45^0 or less for a oscillating roller follower.

42. What are the main factors influencing cam forces?

The main factors influencing cam factors are displacement of follower, cam speed; dynamic forces due to backlash and flexibility, linkage dimensions, pressure angle, frictional forces and spring forces.

43. What are the types of failures in cams?

Cam often fails due to wear or surface fatigue action. Due to rolling and sliding or combination of both the wear and fatigue failure occur in cams.

44. How can surface stresses be reduced by redesign of cam?

The surface stresses can be reduced through redesign of cam by,

- a) Increasing the cam size.
- b) Changing to an offset or swinging follower.
- c) Reducing the cam speed.
- d) Increasing the cam rise angle.
- e) Increasing the thickness of the cam.
- f) Using more suitable cam curve or modifying the curve at critical points.

45. What are the parameters required to design a plate cam?

To design a plate cam with reciprocating follower, the geometric parameters required are,

- a) Prime circle radius.
- b) Minimum width of the follower face and
- c) Offset of the follower face.

46. When does the interference occur in cams?

The interference is occurred in the cams when the radius of roller is too large or when the cam profile is too sharp. Interference usually occurs in cams fitted with flat followers.

47. What is the influence of profile errors in the cam operation?

During cam manufacturing several surfaces imperfections may occur, such as profile errors, waviness and roughness. These surface irregularities may induce shock, noise, wear and vibrations to the cam and follower systems.

48. Define pitch curve of a cam.

The pitch curve of a cam is the locus generated by trace points as the follower moves relative to the cam. For a knife edge follower the pitch curve and the cam profile are same. For a roller follower cam they are separated by the radius of roller.

49. What is a clutch and why it is necessary?

A clutch is a machine used to connect a driving member with drive member. The clutch is required for the following:

- a) To connect and disconnect at with, without stopping.
- b) To avoid overloading of the driving member.

50. What are the different friction linings used in the clutches?

The following friction linings are commonly used in clutches.

- a) Woven.
- b) Asbestos lining.
- c) Moulded asbestos pads, sintered metal pads, etc.

51. How the power is transmitted by clutches?

In clutches, power transmission is achieved through interlocking, friction and wedging.

52. Differentiate clutches with flange couplings.

Flange coupling are used as permanent connecting elements, whereas clutches are used as temporary connecting elements and hence periodical engagement is possible in clutches connection.

Flange couplings are having less number of parts such as flanges, bolts, keys etc., whereas the clutches consists comparatively of large number of parts such as friction discs, springs, bolts, keys, supporting plates and so on.