UNIT- III
BEVEL AND WORM GEARS

1. What is the helix angle of a herringbone gear?

The helix angle of a herringbone gear ranges from 25° to 40°

2. What is the virtual number of teeth in helical gears?

Virtual number of teeth is the number of teeth on equivalent spur gear in the normal plane. The tooth profile of equivalent spur gear tooth is identical to the tooth profile of the helical gear tooth in the normal plane.

3. What is the specific feature of meter gear?

Meter gear is the special type of crown gear in which the shaft angle is 90° and the pitch angles of the pinion and gear are equal and each angle is equal to 45°

4. What is the virtual number of teeth in bevel gears?

Virtual number of teeth is the number of teeth on a spur gear having radius equal to the back cone radius. The profile of the tooth in the equivalent spur gear is identical to the profile of the bevel gear tooth ion the transverse plane.

5. Why the efficiency of worm gear drive is comparatively low?

Meshing of wheel teeth and worm wheel occur with sliding action. Hence, friction and heating occurs. This makes the efficiency of the power transmission low.

6. When the number of start of a worm is increased in a worm gear drive and how it affects the other parameters and the action of the drive?

When the number of start of a worm is increased in a worm gear drive it increases the efficiency of the drive. Number of teeth in a worm wheel = I * Z (Z- Number of starts, I- Velocity ratio)

7. What are hypoid gears?

The axes are non parallel and non-interesting and the tooth are curved then it is called hypoid gears.

8. List out the different types of failures in worm gear drives.

a) Seizure
b) Pitting
c) Rupture

9. What are face gears?

Spur gear pinion meshes with a ring gear having conjugate teeth cut into the face of it. The advantage is that spur gear cutters and gear shapers can be used to produce face gears.

10. What types of materials are used in worm wheels?

Normally worms are made integral with the shaft. Smaller worm wheels are made from solid blanks while larger ones are made from fabricated blanks.

11. What is correction gear? Correction of gear teeth is done to avoid undercutting when the number of teeth is below a specified limit. It is done by a correction factor ‘x’ or addendum modification coefficient. The gears whose teeth are corrected by a correction factor are called correction gear.

12. What is crown gear?

When the bevel gear connects two shafts whose axes intersect at an angle greater than a right angle and one of the bevel gears has a pitch of 90°, then it is known as crown gear.

13. What is the main disadvantage of helical gear drive?

The helical gears in drive will produce axial thrusts. The axial thrusts can be eliminated by the use of double helical gears. Both hands produce axial thrusts which are equal and opposite to each other, so they nullify each other.

14. What is herringbone gear?

A gear fabricated such that half of its width is cut with helix I one direction and other half of the teeth are cut in opposite direction is called herringbone gear.

15. Define the following gears.

A) Zero bevel gears. B) Hypoid gear.

- Zero bevel gears are a patented bevel gear, having curved teeth with a zero spiral angle.
- Hypoid gear is similar to spiral gear but with the axis of the pinion is offset from the axis of the gear. In hypoid gears, pitch surfaces are hyperboloids of revolution.

16. Define back cone radius for a bevel gear.

It is the length of the pitch of the cone. It is also called as pitch cone radius.

17. Name the materials used for the manufacture of worm and worm wheel.

Materials for worm- Low carbon alloy steel, medium carbon alloy steel.

Materials for worm wheel- Cast iron, tint less brass and bronze.

18. How efficiency if worm drive can be increased?

Worm gear efficiency can be increased by either,

a) Increasing the lead angle
b) Using multi start worm with small diameter
c) Improving finish, lubrication, etc
d) Using rigid, non- yielding worms with a smooth, ground or polished flanks

19. What are the profiles used for worm?

Trapezoidal profile, Arcmedian spiral profile, CAVEX, special profile designed by Brown and Bostock- Renk

20. In which gear drive self locking is available?

Self locking is available in worm and worm wheel. Condition for self locking is the friction angle of the surfaces in contact is greater than the lead angle of the worm.

21. What is single enveloping and double enveloping worm?

In the worm gear drive, to increase the length of the line of contact the wheel surface or worm surface or both is made to concave shape.

22. Why heat dissipation is a very important aspect in design of worm gear drive?

In most of the worm gear units, the power transmitting capacity is limited by the heat dissipation ability of the casting. Due to sliding between worm thread and worm wheel tooth a great amount of heat is generated. The generated heat has to be dissipated for proper functioning of the gear drive. So the heat dissipation is a very important factor in design of worm gear drive.

23. Write the advantages of helical gears over spur gears.

One primary disadvantage of spur gears is that their initial contact upon meshing is a line contact. Instantaneous line contact produces shock effect which results in reduced load capacity and noisy operation. The problem is alleviated when helical gears are used because the initial contact point which becomes a line of increasing length as contact continues.

24. Write the different types if bevel gears.

a) Straight bevel
b) Zero bevels
c) Spiral bevel
d) Face bevel
e) Skew bevel
f) Hypoid bevel

25. What is the mounting height of a bevel gear?

It is the distance of the back of the boss from the cone center.

26. Where do we use skew helical gears?

When the helical gears are based on the non- parallel, non- intersecting shafts and mesh with each other, they form a skew gearing or crossed helical gearing. These gears are used to drive cam shafts and auxiliaries on small internal combustion, feed mechanism on machine tools, distributor drive of automobile engines, etc.

27. What is cone distance and face angle of a bevel gear?

Cone distance is the length of the pitch cone element. It is also called as itch cone radius.

Face angle is the angle suspended by the face of the tooth at the cone centre. The face angle is equal to the pitch angle plus addendum angle. It is denoted by Φ

28. What is the distance of bevel gear?

It is the length of the pitch cone element. It is also called as pitch cone radius.

29. Differentiate between the normal pitch and axial pitch in helical gears.

The axial pitch is the distance parallel to the axis between similar faces of adjacent teeth, whereas normal pitch is the distance between similar faces of adjacent teeth along a helix on the pitch cylinders normal to the teeth.

30. What are the types of failure in worm gear drives?

a) Seizure
b) Pitting
c) Surface wear

31. What is irreversibility in worm gears and how is it obtained?

The worm drive is so designed that the gear cannot turn the worm although the worm can turn the gear. If the worm wheel is unable to drive the worm, the phenomenon is called irreversibility. It is obtained by having the friction angle or worm angle greater that the lead angle.

32. When do we use bevel gears? Bevel gears are used to transmit power from one shaft to another, when the two shafts intersect each other by any angle.

33. Give the applications of bevel gear.

Bevel gears are used in

- Rear axle drives of automobiles
- Vertical spindle of a drilling machine
- Elevating screws of cross rail of planner
- Milling & shaping machine

34. What are the advantages of spiral bevel gears over straight teeth bevel gears?

The advantages of the curved tooth spiral gears over the straight ones are in general the same of helical gears over spur gears, namely lesser noise, greater contact ration, gradual engagement of the mating teeth, greater load carrying capacity, lesser vibrations.

35. What are the advantages of hypoid gears over straight teeth bevel gears?

The advantage of hypoid gears are comparatively smoother action and possibly of extending the shafts past each other. So the bearings can be used on both sides of the gear and the pinion. This makes the drive more rigid and hence higher power can be transmitted than bevel gears.

36. Differentiate between spiral bevel gears and hypoid gears.

The spiral and hypoid gears are similar and most important difference being that the pinion gear set is offset above or below the gear axis.

37. What is the difference between angular gears and miter gears?

The bevel gears with shaft angle 90° are miter gears and the bevel gears with any other shaft angles are termed as angular gears.

38. Define the following terms for bevel gears.

A) Pitch angle B) Face angle

Pitch angle:

It is the angle made by the pitch line with the axis of the shaft.

Face angle:

It is the angle subtended by the face of the tooth at the cone centre.

Face angle = Pitch angle + addendum angle.

39. State the approximation suggested for finding the radius or equivalent spur gear of any bevel gear.

The equivalent spur gear of a straight tooth bevel gear is obtained by developing the tooth from along a back cone. The back cone is considered as the radius of equivalent spur gear at the mean face width on the pitch cone.

40. What are the factors decide the direction of axial thrust acting on a spiral bevel gear?

a) Hand of the spiral
b) Direction of rotation
c) Whether the gear is a driver or a driven member

41. When do you prefer worm and worm wheel drive?

a) In large reduction in velocity ratio is required
b) Self locking specialty is required
c) To connect non-intersecting perpendicular shafts

42. What are the types of bevel gears?

- Miter gears
- Angular bevel gears
- Crown gears

43. What are the types of worms?

- Cylindrical or straight worm
- Single enveloping worm
- Double enveloping worm

44. What are the losses of power in worm gear drive?

The losses in worm gear drive are friction loss and oil churning loss.

45. On what basis gear cutter is selected?

The cutter is selected on the basis of gear tooth system, module and number of teeth to be cut.

46. When will you use web and arm type construction for gears?

Web type construction:

Gears up to 250mm circle diameter

Arm type construction:

Gears having PCD more than 250mm

47. Define the term axial pitch and normal pitch in worm gearing.

Axial pitch is the distance between a point on a worm thread and corresponding point on the adjacent thread measured parallel to the axis of the worm.

Normal pitch is the distance between a point on a wheel thread and corresponding point on the adjacent thread measured perpendicular to helix.

48. What are the different criteria of deciding power to be transmitted by the worm gearing?

The power transmitting capacity of worm gearing is decided by the strength, the ability to resist wear and abrasion and the heat dissipating capacity of the drive.

49. Why dynamic loading is rarely considered in worm gear drives?

Because of sliding between the worm and worm gear teeth, the dynamic forces are not so severe as in the regular forms of worm gearing. So the dynamic loading is rarely considered in worm gear drives.

50. Differentiate between normal pitch and axial pitch in helical gears.

The axial pitch is the distance parallel to the axis between similar faces of adjacent teeth, where as normal pitch is the distance between similar faces of adjacent teeth along a helix on the pitch cylinders normal to the teeth.