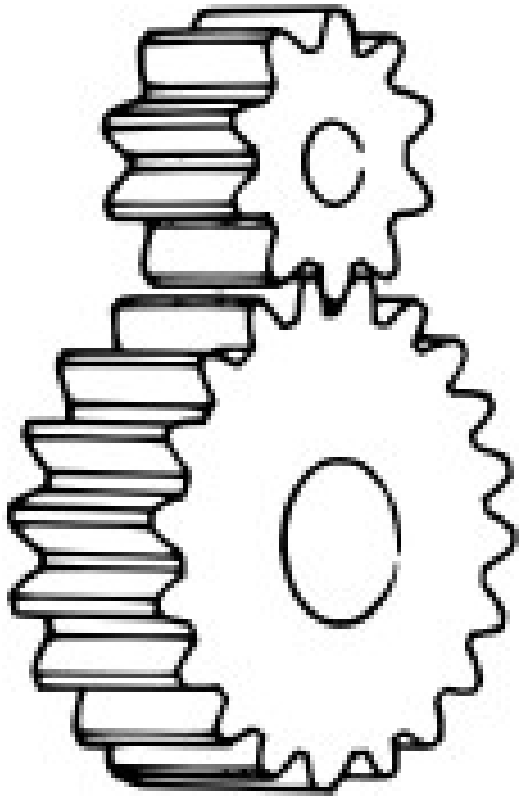
CHAPTER-8
Gears

A **gear** is a rotating machine part having cut teeth



Classification of Gear

The gears can be classified in the following way:-

1. Depending on the relative position of the geometrical axes of the driving and driven shaft
2. Depending upon the housing design.
3. Depending upon the peripheral Velocity.
4. Depending upon the shape of teeth.

Depending on the relative position of the geometrical axes of the driving and driven shaft

Parallel Shaft

1. Spur Gears
2. Helical Gears
3. Herringbone

Intersecting Shafts

1. Miter Gears
2. Face Gears
3. Zero Bevel Gears
4. Straight Bevel Gears
5. Spiral Bevel Gears

Non-parallel, Non Intersecting Shafts

1. Spiral Gears
2. Hypoid Gears
3. Worm Gears

Depending upon the housing design

- **Open Drives**:- The gear drive is without a casing and is subjected to the action of dust and dirt.
- **Closed Drives**:- The gear Drives are enclosed in special casings and are protected against dirt and dust and are properly lubricated.

Depending upon the peripheral Velocity

1. **Low Velocity:** V is < 3 m/s.
2. **Medium Velocity:** V=3 to 15 m/s.
3. **High Velocity:** V is>15 m/s.

DIGITAL LINK FOR TYPE OF GEAR

1 https://youtu.be/jTfUFQ-sbas

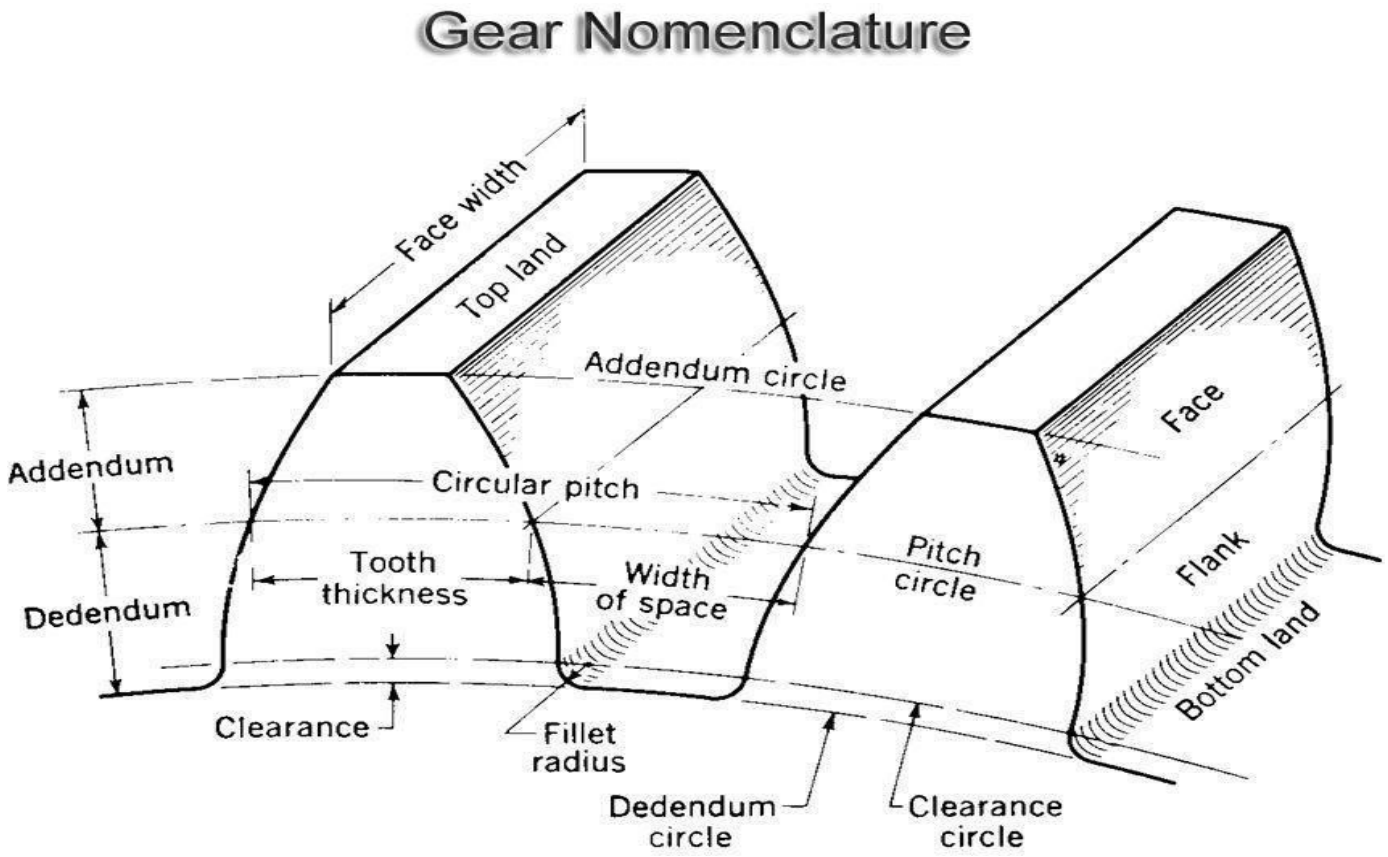
Depending Upon the Type of Gearing

- External Gearing The teeth are provided on the external surfaces
- Internal Gearing The teeth are provided on the internal surfaces
- Rack and Pinion it has infinite Pitch Diameter

Depend upon shape of teeth of the Gear

- Straight teeth Gear it has straight Teeth
- Helical teeth Gear it has helical Teeth
- Herringbone Teeth Gear same as double helical gears but there is no space between the opposite sets of teeth
- Curved Teeth Gear the teeth are Curved

Gear Nomenclature



Gear Nomenclature

DIGITAL LINK FOR NOMENCLATURE OF GEAR

1 https://youtu.be/ococqpOzbt8

2 https://youtu.be/YtFAjaN8r7k

1. **Pitch circle**

   Pitch circle is the imaginary circle that rolls without slipping with a pitch circle of a mating gear.

2. **Pitch Circle Diameter**

   The pitch circle diameter is the diameter of the pitch circle. It is also known as pitch diameter.

3. **Pressure angle**

   Pressure angle is the angle between the common normal at the point of tooth contact and the common tangent to the pitch circle. The usual pressure angles are 14½° and 20°.

4. **Pitch point**

   It is a common point of contact between two pitch circles.

5. **Pitch surface**

   It is the surface of the imaginary rolling cylinder that the toothed gear may

be considered to replace.

Gear Nomenclature

6. Addendum

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

7. Dedendum

Dedendum is the circle drawn through the bottom of the teeth. It is also called “root circle”.

8. Addendum circle

It is the circle drawn through the top of the teeth and it is concentric with the pitch circle.

9. Dedendum circle

It is the circle drawn through the bottom of the tooth. It is also called “root circle”.

10. Base Circle

The base circle of involute gear is the circle from which involute tooth profiles are determined.

Gear Nomenclature

11. Circular pitch

The circular pitch is the distance measured on the circumference of the pitch circle from a point of one tooth to the corresponding point on the next tooth. It is denoted by Pc.

$Pc = \pi d/T$

D = diameter of the circle

T = No. of teeth on the wheel

12. Diametral Pitch

It is the ratio of a number of teeth to the pitch circle diameter. It is indicated by Pd.

$Pd = T/d = \pi/Pc$

$Pc = \pi d/T$

Where,

T= No. of teeth,

d= Pitch circle diameter.

13. Module

A module is the ratio of pitch circle diameter by m. m= d/T

14. Clearance

Clearance is the difference between the dedendum of one gear and the addendum of the mating gear.

Gear Nomenclature

15. Total Depth

Total depth is the radial distance between the addendum and the dedendum of a gear. It is equal to the sum of addendum and dedendum.

16. Working Depth

It is the radial distance from the addendum circle to the clearance circle. It is equal to the sum of the addendum of the two meshing gears.

17. Tooth thickness

Tooth thickness is the width of the tooth measured along the pitch circle.

18. Tooth space

Tooth space is the width of space between the two adjacent teeth measured along the pitch circle.

19. Face of the tooth

It is the surface of the tooth above the pitch surface.

20. Flank of the tooth

The flank of the tooth is the surface of the tooth below the pitch surface.

Gear Nomenclature

21. Top land

The top land is the surface of the top of the tooth.

22. Face width

Face width is the width of the gear tooth measured parallel to its axis.

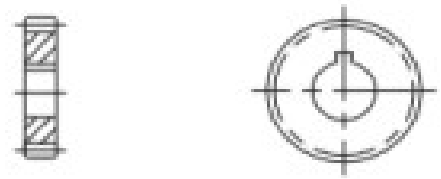
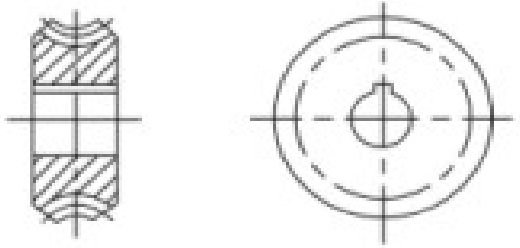
23. Profile

It is the curve formed by the face and flank of the tooth.

24. Backlash

Backlash is the difference between the thickness of a tooth and the width of a tooth space on which it meshes.

Convention of Gears

Title	Convention
Spur gear	
Bevel gear	
Worm wheel	
Worm	

Draw the actual profile of involutes teeth of spur gear by different methods

There are two methods given of construction of Spur gear profile

- Tracing Paper Method
- Base Circle Method

DIGITAL LINK FOR INVOLUTE OF SPUR GEAR BY BASE CIRCLE METHOD

1 https://youtu.be/nQOdjP6KO54

DIGITAL LINK FOR INVOLUTE OF SPUR GEAR BY TRACING PAPER METHOD

1 https://youtu.be/lxiLnEOiW1w

Draw the actual profile of involutes teeth of spur gear by different methods

Problem 13.1. Draw the profile of involute teeth for a gear having 22 teeth and diametral pitch 0.1 tooth/mm. Assume pressure angle = 20°. Use tracing paper method.

Solution. Given, $T = 22,\ P_d = 0.1$ tooth/mm , $\phi = 20°$

$$\text{Module, } m = \frac{1}{P_d} = \frac{1}{0.1} = 10 \text{ mm}$$

Pitch circle diameter, $d = m \times T$

$= 10 \times 22 = 220$ mm

Circular pitch, $P_c = \pi \times m$

$= \pi \times 10 = 31.4$ mm

Addendum $= 1\ m = 10$ mm

Addendum circle diameter $= d + 2 \times$ Addendum

$= 220 + 2 \times 20 = 240$ mm

Clearance $= 0.157\ m = 0.157 \times 10 = 1.57$ mm

Dedendum = Addendum + Clearance $= 10 + 1.57 = 11.57$ mm

Dedendum circle diameter $= d - 2 \times$ Dedendum $= 220 - 2 \times 11.57 = 196.86$ mm

$$\text{Tooth thickness} = \frac{P_c}{2} = \frac{31.4}{2} = 15.7 \text{ mm}$$

$$\text{Fillet radius} = \frac{P_c}{8} = \frac{31.4}{8} = 3.9 \text{ mm}$$

Draw the actual profile of involutes teeth of spur gear by different methods

Problem 13.1. Draw the profile of involute teeth for a gear having 22 teeth and diametral pitch 0.1 tooth/mm. Assume pressure angle = 20°. Use tracing paper method.