

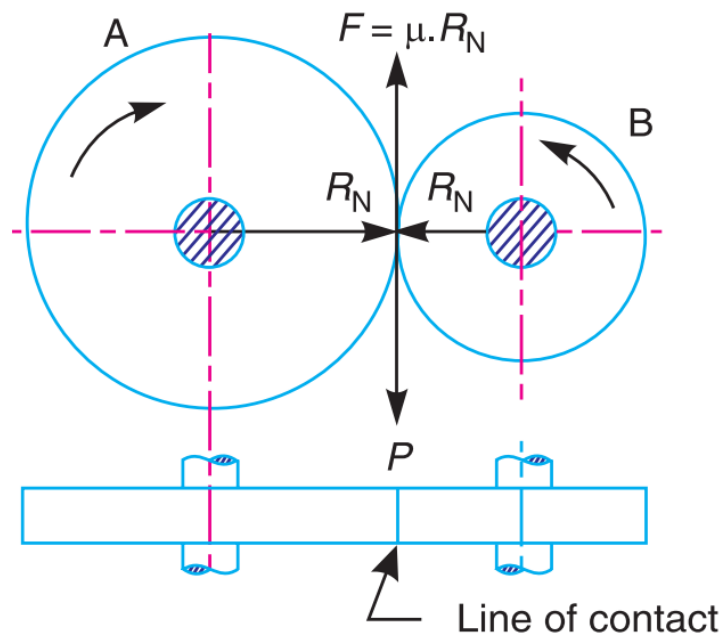
**ME3491 THEORY OF MACHINES**

**UNIT II NOTES**

### 2.1.1. Friction wheels and Gears

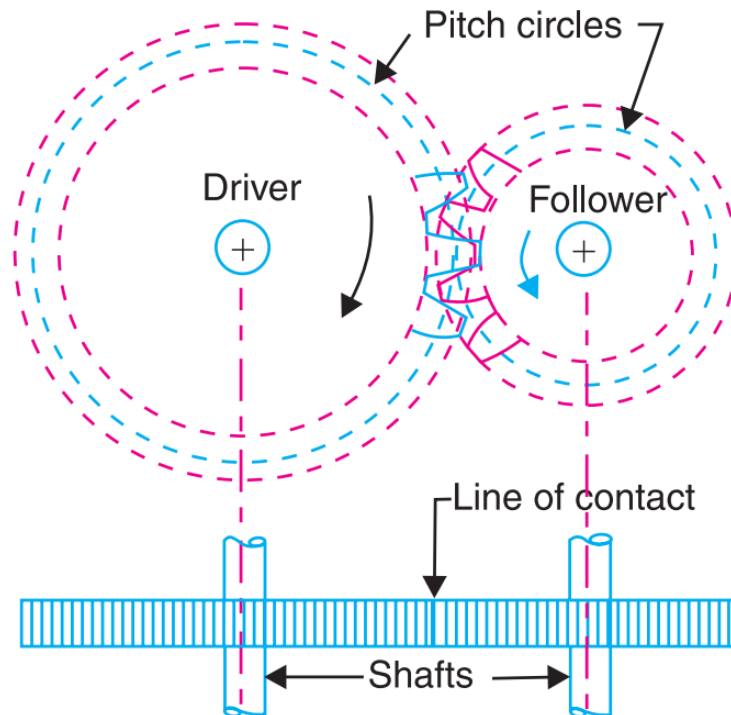
The motion and power transmitted by gears is kinematically equivalent to that transmitted by friction wheels or discs. In order to understand how the motion can be transmitted by two toothed wheels, consider two plain circular wheels A and B mounted on shafts, having sufficient rough surfaces and pressing against each other.

Let the wheel A be keyed to the rotating shaft and the wheel B to the shaft, to be rotated. A little consideration will show, that when the wheel A is rotated by a rotating shaft, it will rotate the wheel B in the opposite direction as shown in Figure.



Friction wheels.

In order to avoid the slipping, a number of projections (called teeth) as shown in Figure, are provided on the periphery of the wheel A, which will fit into the corresponding recesses on the periphery of the wheel B. A friction wheel with the teeth cut on it is known as toothed wheel or gear. The usual connection to show the toothed wheels is by their pitch circles.



Toothed wheels.

### 2.1.2 Advantages

1. It transmits exact velocity ratio.
2. It may be used to transmit large power.
3. It has high efficiency.
4. It has reliable service.
5. It has compact layout.

### 2.1.3 Disadvantages

1. The manufacture of gears require special tools and equipment.
2. The error in cutting teeth may cause vibrations and noise during operation.

## 2.2 Classification of Toothed Wheels

The gears or toothed wheels may be classified as follows :

### 1. 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.

The two parallel and co-planar shafts connected by the gears is shown in Figure. These gears are called spur gears and the arrangement is known as **spur gearing**. These gears have teeth parallel to the axis of the wheel as shown in Figure. Another name given to the spur gearing is helical gearing, in which the teeth are inclined to the axis.

The single and double helical gears connecting parallel shafts. The double helical gears are known as **herringbone gears**. A pair of spur gears are kinematically equivalent to a pair of cylindrical discs, keyed to parallel shafts and having a line contact.

The two non-parallel or intersecting, but coplanar shafts connected by gears is shown in Figure. These gears are called bevel gears and the arrangement is known as bevel gearing. The bevel gears, like spur gears, may also have their teeth inclined to the face of the bevel, in which case they are known as **helical bevel gears**.

The two non-intersecting and non-parallel i.e. non-coplanar shaft connected by gears is shown in Figure. These gears are called **skew bevel gears or spiral gears** and the arrangement is known as skew bevel gearing or spiral gearing. This type of gearing also have a line contact, the rotation of which about the axes generates the two pitch surfaces known as hyperboloids.

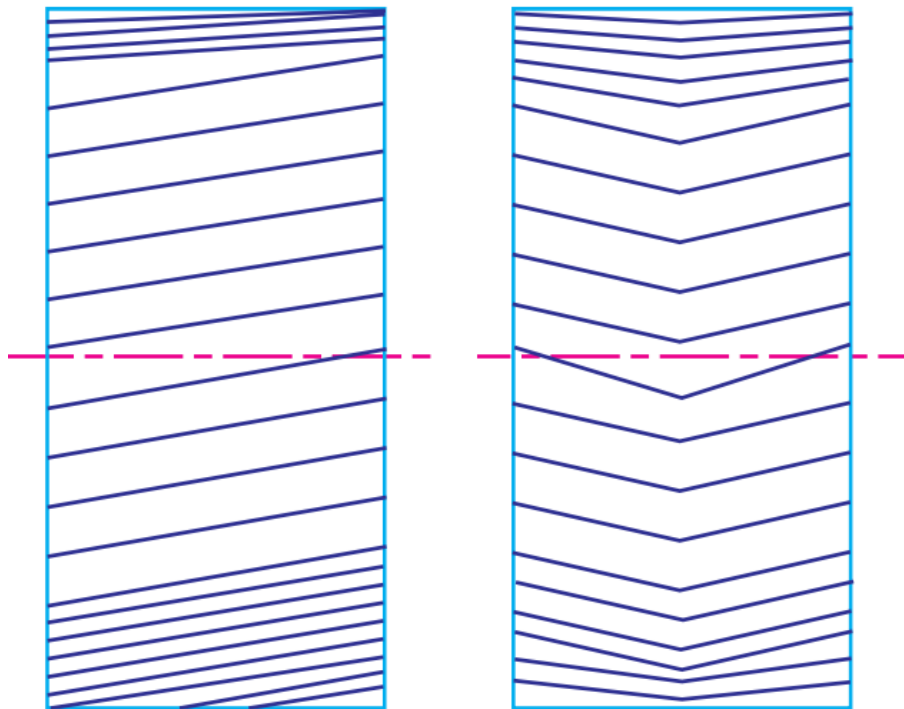
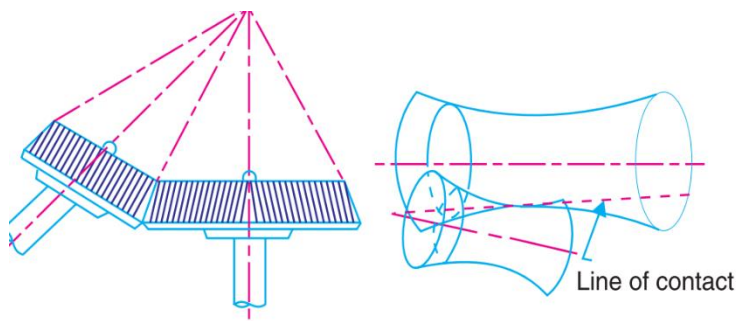


Figure: single and double helical gear



(c) Bevel gear.

(d) Spiral gear.

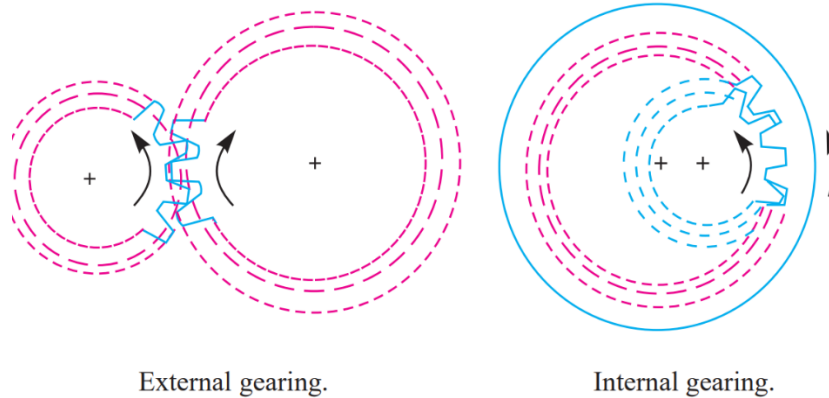
## 2. According to the peripheral velocity of the gears.

The gears, according to the peripheral velocity of the gears may be classified as : (a) Low velocity, (b) Medium velocity, and (c) High velocity. The gears having velocity less than 3 m/s are termed as low velocity gears and gears having velocity between 3 and 15 m/s are known as medium velocity gears. If the velocity of gears is more than 15 m/s, then these are called high speed gears.

## 3. According to the type of gearing.

The gears, according to the type of gearing may be classified as : (a) External gearing, (b) Internal

gearing, and (c) Rack and pinion. In external gearing, the gears of the two shafts mesh externally with each other as shown in Figure. The larger of these two wheels is called spur wheel and the smaller wheel is called pinion. In an external gearing, the motion of the two wheels is always unlike.



#### 4. According to position of teeth on the gear surface.

The teeth on the gear surface may be (a) straight, (b) inclined, and (c) curved.

Spur gears have straight teeth where as helical gears have their teeth inclined to the wheel rim. In case of spiral gears, the teeth are curved over the rim surface.