UNIT -1

Design of V- Belts and Pulleys

1. Design Parameters to Consider

- **Power to be Transmitted (P)**: The amount of power required by the system.
- **Speed of the Driver and Driven Shafts (N1, N2)**: Determines the velocity ratio.
- **Center Distance (C)**: The distance between the axes of the driver and driven pulleys.
- **Belt Material**: Determines durability, flexibility, and load capacity.
- **Environmental Conditions**: Temperature, humidity, dust, and chemical exposure.

2. Steps in Designing V-Belts and Pulleys

a. Selection of Belt Type and Section

- Common V-belt sections: A, B, C, D, E (standard sizes).
- Selection depends on:
  - Power to be transmitted.
  - Speed of operation.
  - Space availability.
- Refer to manufacturer catalogs for specific ratings and dimensions.

b. Determination of Belt Length (L)

The belt length can be calculated using the formula:

$$L = 2C + \frac{\pi}{2}(D_1 + D_2) + \frac{(D_2 - D_1)^2}{4C}$$

Where:

- C: Center distance between pulleys.
- D_1: Diameter of the smaller pulley.
- D_2: Diameter of the larger pulley.

c. Pulley Diameter and Speed Ratio

- Velocity Ratio (VR):

$$VR = \frac{N1}{N2} = \frac{D2}{D1}$$

- Select pulley diameters based on the required velocity ratio.

d. Calculation of Belt Speed (V)

The speed of the belt is given by:

$$V = \frac{\pi D_1 N_1}{60}$$

Where:

- V: Belt speed (m/s).
- D_1: Diameter of the driver pulley (m).
- N_1: Speed of the driver pulley (RPM).

e. Power Capacity of the Belt

The power transmitted by the belt is:

$$P = T \cdot V$$

Where:

- T: Effective tension in the belt.
- V: Belt speed.

  Ensure the belt can handle the transmitted power by consulting manufacturer data.

f. Groove Angle of Pulley

- Typical groove angles: 34° to 38° (standard).
- Groove angle affects the grip and friction between the belt and pulley.

g. Number of Belts

- For higher power, multiple belts may be required.
- The number of belts (n) is determined as:

$$n = \frac{P_{\text{required}}}{P_{\text{per belt}}}$$

h. Checking Belt Tension

- **Initial Tension (T0)**: Ensures proper grip and power transmission.
- Calculated using:

$$T_0 = \frac{T_1 + T_2}{2}$$

Where T_1 and T_2 are the tight and slack side tensions, respectively.

3. Pulley Material Selection

- **Common Materials**: Cast iron, steel, aluminum.
- **Factors**: Load, speed, environment, cost.

4. Advantages of V-Belt Drive

- High power transmission capability.
- Compact design.
- Damping of shocks and vibrations.
- Low maintenance requirements.

5. Limitations of V-Belt Drive

- Slippage can occur under high loads.
- Efficiency decreases at higher speeds due to centrifugal forces.
- Not suitable for very long-distance power transmission.