



## UNIT -1

### Applications of Power Transmission

#### 1. Electrical Power Transmission

- ✓ **Power Grids:** High-voltage transmission lines deliver electricity from power plants to substations and eventually to consumers.
- ✓ **Renewable Energy Integration:** Transmitting energy from wind farms, solar fields, and hydroelectric plants to urban centers.
- ✓ **Industrial Use:** Supplying power to manufacturing plants, machinery, and other heavy industries.

#### 2. Mechanical Power Transmission

- ✓ **Automotive Systems:** Gearboxes, driveshafts, and differentials in vehicles transmit mechanical energy from engines to wheels.
- ✓ **Industrial Machinery:** Belt drives, chain drives, and gear systems transmit power in conveyor belts, pumps, and other equipment.
- ✓ **Aerospace:** Power transmission systems in aircraft, such as engines driving propellers or turbines.

#### 3. Fluid Power Transmission

- ✓ **Hydraulics:** Used in heavy machinery like excavators, forklifts, and cranes for precise control and high force.
- ✓ **Pneumatics:** Compressed air systems are used in tools, automation, and material handling.

#### 4. Telecommunication Systems

- ✓ **Optical Power Transmission:** Fiber optics transmit light energy for high-speed data communication.
- ✓ **Microwave Transmission:** Used in wireless communication and radar systems.

# Limitations of Power Transmission

## 1. Electrical Transmission

- ✓ **Losses:** Energy losses due to resistance ( $I^2R$  losses) and inefficiencies in transformers and conductors.
- ✓ **Cost:** High setup costs for transmission infrastructure, especially for long distances and high-voltage systems.
- ✓ **Environmental Impact:** Overhead lines can affect landscapes and ecosystems.
- ✓ **Stability:** Susceptible to faults, such as short circuits, which can lead to blackouts.

## 2. Mechanical Transmission

- ✓ **Wear and Tear:** Components like belts, chains, and gears degrade over time, requiring maintenance.
- ✓ **Efficiency:** Friction and misalignment reduce efficiency in mechanical systems.
- ✓ **Distance Limitation:** Mechanical systems are effective over shorter distances due to increased energy loss over long spans.

## 3. Fluid Power Transmission

- ✓ **Energy Loss:** Hydraulic and pneumatic systems experience losses due to leakage and friction in pipes.
- ✓ **Complexity:** Systems require precise design and maintenance to prevent breakdowns.
- ✓ **Environmental Concerns:** Hydraulic fluids can leak and contaminate the environment.

## 4. Telecommunication Power Transmission

- ✓ **Signal Attenuation:** Optical and microwave transmissions can suffer from losses over long distances.
- ✓ **Infrastructure Requirements:** High investment in cables, towers, and repeater stations.