5.1 Fixed and dynamic spectrum Access

Fixed Spectrum Access

1. Definition

- Fixed spectrum access refers to a traditional method of allocating specific frequency bands to users or services. Each user is assigned a designated portion of the spectrum for exclusive use.

2. Characteristics

- **Exclusive Use**: Users have dedicated access to their assigned frequency bands, which cannot be used by others.
- **License-Based**: Typically involves licensing from regulatory authorities (e.g., FCC in the U.S. or TRAI in India).
- **Predictable Performance**: Provides reliable and consistent service quality since users do not contend with others for access.
- **Inefficiency**: Can lead to underutilization of spectrum, as assigned bands may remain idle during periods of low demand.

3. Applications

- Commonly used for broadcasting, cellular networks, and fixed wireless services.

Dynamic Spectrum Access

1. Definition

- Dynamic spectrum access (DSA) allows users to access and utilize available frequency bands based on current demand and availability, enabling more flexible and efficient use of the spectrum.

2. Characteristics

- **Opportunistic Access**: Users can access spectrum that is not currently in use by licensed holders (secondary users).
- **Spectrum Sensing**: Involves technologies that detect unused spectrum (white spaces) and enable access without interfering with primary users.
- **Improved Efficiency**: Maximizes spectrum utilization by allowing multiple users to share bands dynamically, reducing idle spectrum.
- **Regulatory Framework**: Often requires supportive regulatory policies to manage interference and ensure fair access.

3. Applications

- Useful in various contexts, such as cognitive radio networks, emergency communication systems, and broadband wireless access.

Comparison

Feature	Fixed Spectrum Access	Dynamic Spectrum Access
Access Type	Exclusive use by licensed users	Opportunistic access to available bands
Utilization	Potentially inefficient	Efficient and flexible
Regulatory Approach	License-based, fixed allocations	Needs adaptive policies and spectrum sensing
Interference Management	Less concern, as bands are exclusive	Requires advanced management to avoid interference
Technological Complexity	Simpler, traditional systems	More complex due to sensing and sharing technologies