2. Summarize the functionalities of MPEG-4 and explain why it is widely used in multimedia applications.

ans MPEG-4 (Moving Picture Experts Group-4) is an international multimedia compression standard developed by the Moving Picture Experts Group. It is designed to efficiently encode audio-visual data for storage and transmission access networks.

Functionalities of MPEG-4

(1) Advanced Video compression.

- Uses efficient compression techniques.
- Provides high video quality at low bit rates
- Enables streaming over limited bandwidth networks.

(2) Audio Compression.

- Supports high-quality audio coding formats.
- Offers better sound quality than older formats at similar bitrates.

(3) Object-Based Coding

- Unlike earlier standards, MPEG-4 treats audio, video, text, graphics, and animation as separate objects.
- Allows interative multimedia.

(4) Support for Streaming Media.

- Optimized for internet streaming.
- Handles real-time transmission with error resilience

(5) Scalability

- Supports:
  - Bitrate scalability
  - Spatial scalability
  - Temporal scalability

(6) Multimedia Integration.

- Combines video, audio, subtitles, 2D/3D graphics.
- Supports interactive applications and virtual environments.

(7) File format Support

- Uses the MP4 container format:
  - MP4
- Stores video, audio, subtitles, and metadata in a single file.

Why MPEG-4 is Widely Used in Multimedia Applications.

(1) High Compression Efficiency.

- Reduces file size significantly.
- Saves storage space and bandwidth.

(2) Internet & Streaming Friendly

- Ideal for:
  - YouTube
  - OTT platforms.
  - Video Conferencing.
- Works well over 3G/4G/5G networks

(3) Device Compatibility.

- Supported by:
  - Smartphones.
  - Smart TVs
  - Laptops.
  - Gaming Consoles.

(4) Flexibility & Interactivity.

- Supports multimedia-rich applications like:
  - online games.
  - E-learning.
  - Virtual reality environments.