1. What are the different 802.11 PHY layer standards? Compare their characteristics.

802.11 – operates in the 2.4 GHz band with a maximum data rate of 2 Mbps using DSSS or FHSS modulation. It was the original Wi-Fi standard.

802.11a – operates at 5 GHz and supports speeds up to 54 Mbps using OFDM.

802.11b – It works on the 2.4 GHz band with a maximum speed of 11 Mbps using DSSS. It has good range and low cost.

802.11g – It uses the 2.4 GHz band like 802.11b but supports speeds up to 54 Mbps with OFDM.

802.11n – It can operate in both 2.4 GHz and 5 GHz bands, with speeds up to 600 Mbps.

802.11ac – This standard works in the 5 GHz band and supports speeds over 1 Gbps using MU-MIMO and wider channels.

802.11ax – It operates in both 2.4 GHz and 5 GHz bands with speeds up to 9.6 Gbps. It uses OFDMA, 1024-QAM modulation.

802.11be (Wi-Fi 7) – This standard will support 2.4, 5, and 6 GHz bands with speeds up to 30 Gbps using 4096-QAM and ultra-wide 320 MHz channels.

2. What are DSSS and FHSS? How do they work?

DSSS - Direct Sequence Spread Spectrum :

Used in 802.11b. It Spreads data by multiplying it with a pseudo-random noise code.

Uses the entire bandwidth, resistant to narrowband interference.

FHSS - Frequency Hopping Spread Spectrum :

Used in early 802.11 but phased out in favour of DSSS and OFDM . It Transmits by hopping rapidly between frequencies.

More resistant to frequency interference, but less data rate.