**Assignment: Wireless Technology and Mobile Computing**

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**Course: Wireless Technology and Mobile Computing (SCSC 452)**

**Level: 400**

ASSIGNMENT

**QUESTION ONE (1)**

Explain the following Wireless Terminologies

a. Attenuation

b. Interference

c. Modulation

d. Spectrum

e. Frequency

**a. Attenuation**

### Attenuation

Attenuation refers to the gradual loss of signal strength as it travels through a medium. In wireless communications, attenuation occurs when radio waves lose energy as they propagate through the air, buildings, or other obstacles. Factors affecting attenuation include:

### b. Interference

Interference do normally happens when unwanted signals disrupt or degrade the quality of the desired wireless signal.

### c. Modulation

Modulation is how data is added to a radio signal for transmission. It’s like tuning a radio station to carry different kinds of music. There are different types:

AM (Amplitude Modulation) – Changes the signal’s strength.

FM (Frequency Modulation) – Adjusts the signal’s frequency.

PM (Phase Modulation) – Alters the timing of the signal.

QAM (Quadrature Amplitude Modulation) – Combines amplitude and phase modulation for faster data transfer.

**d. Spectrum**

The spectrum is the range of frequencies used for wireless communication. Think of it as a highway where different lanes (frequencies) are assigned to different types of communication like Wi-Fi, mobile networks, and radio stations. Government agencies like the FCC (USA) or ITU (global) manage who can use which parts of the spectrum to prevent overcrowding and interference.

### e. Frequency

Frequency is how often a signal wave repeats in one second, measured in Hertz (Hz).

Lower frequencies (e.g., 700 MHz) travel farther and pass through walls better.

Higher frequencies (e.g., 5 GHz) offer faster speeds but cover shorter distances.

Different wireless technologies work in specific frequency bands to avoid interference and maximize performance.

**QUESTION 2**

How has wireless technology transformed mobile computing?

Wireless technology has completely changed how we use mobile devices. Here’s how:

* Always Connected – No need for wired internet; we can stay online anywhere.
* Freedom to Move – Phones, tablets, and laptops work anywhere without cables.
* Cloud Computing – We don’t need massive storage; everything is saved online.
* Apps & Services – Apps like Uber, Google Maps, and streaming platforms depend on wireless networks.
* Smart Devices (IoT) – Wireless tech powers smart homes, smartwatches, and connected gadgets.
* Lighter Devices – Phones and tablets no longer need multiple ports or thick antennas.
* Real-Time Features – GPS, ride-sharing, and video calls work because of wireless speed.
* Remote Work – People can now work from anywhere with stable wireless internet.

**QUESTION THREE (3)**

What are the main differences between 4G and 5G networks?

4G and 5G are both mobile network technologies, but 5G is a major improvement over 4G in several ways.

**4G Networks:**

* Speed and Throughput: Typically deliver speeds up to 100 Mbps in real-world conditions.
* Latency: Operates with latency of approximately 20-30 milliseconds.
* Frequency Spectrum: Primarily operates in frequency bands below 6 GHz.
* Network Architecture: Has a relatively centralized network approach.

**5G Networks:**

* Speed and Throughput: Achieves much higher data rates—reaching theoretical peaks of 10 Gbps and practical speeds of 1-2 Gbps, representing a 10-100x improvement.
* Latency: Dramatically reduces latency to just 1-10 milliseconds, enabling real-time applications like autonomous vehicles and remote surgery.
* Frequency Spectrum: Expands by utilizing three distinct spectrum ranges: low-band (sub-1 GHz), mid-band (1-6 GHz), and high-band millimeter wave (24-100 GHz).
* Network Architecture: Implements a more distributed architecture with edge computing capabilities, moving processing closer to end users.