UNIT-I THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS

2MARKS

1.What is meant by frequency reuse?

A: If an area is served by a single Base Station, then the available spectrum can be divided into N frequency channels that can serve N users simultaneously. If more than N users are to be served, multiple BSs are required, and frequency channels have to be reused in different locations. Since spectrum is limited, the same spectrum has to be used for different wireless connections in different locations. This method of reusing the **frequency is called as frequency reuse.**

2. What is channel assignment? What are the types?

A: For efficient utilization of radio spectrum a frequency reuse scheme with increasing capacity and minimizing interference is required. For this channel assignment is used. The types of channel assignment are: i. Fixed channel assignment ii. Dynamic channel assignment.

3. What is fixed channel assignment?

A: If the channels in each cell are allocated to the users within the cell, it will be called as fixed channel assignment. If all channels are occupied, the call will be blocked.

4. What is dynamic channel assignment?

A: If the voice channels are not allocated permanently in a cell, it will be called as dynamic channel assignment. In this assignment, channels are dynamically allocated to users by the MSC.

5. Write the types of hand off?

A: Types of handoff are:

i.Hard hand off – Mobile monitors BS and new cell is allocated to a call with strong signal.
ii. Soft hand off – MS with 2 or more calls at the same time and find which is the strongest signal BS, the MSC automatically transfers the call to thatBS.

6. Define hand off and mode of hand off?

A: A handoff refers to the process of transferring an active call or data session from one cell in a cellular network to another or from one channel in a cell to another. A well- implemented handoff is important for delivering uninterrupted service to a caller or data session user.

Modes of hand off are: i. MCHO – Mobile Controlled Hand off ii. NCHO – Network Controlled Hand off iii. MAHO – Mobile Assisted Hand off

7. Define Cell, Cluster?

A: For a large geographic coverage area, a high powered transmitter therefore has to be used. But a high power radio transmitter causes harm to environment. Mobile communication thus calls for replacing the high power transmitters by low power transmitters by dividing the coverage area into small segments, called cells. Each cell uses a certain number of the available channels and a group of adjacent cells together use all the available channels. Such a group is called a cluster.

8. What do you mean by foot print and dwell time?

A: The region over which the signal strength lies above this threshold value x dB is known as the coverage area of a BS and it must be a circular region, considering the BS to be isotropic radiator. Such a circle, which gives this actual radio coverage, is called the foot print of a cell. The time over which a call may be maintained within a cell without hand off is called the dwell time.

9.Why the cell shapes are hexagons?

A: Hexagons are geometric shapes that approximate a circle. (for Omni directional radiation) Moreover a circle or triangle will create lot of empty geographical area which is not feasible for wireless communication. Using Hexagon geometry, fewest numbers of cells can cover the entire geographical region..

10. What is blocked call clear system (BCC)?

A: In a system, a user is blocked without access by a system when no channels are available in the system. The call blocked by the system is cleared and the user should try again .This is called BCCsystem.

11. What is blocked call delay system?

A: If a channel is not available immediately, the call request may be delayed until a channel becomes available. This is called as blocked call delay system.

12. Define cell splitting?

A: Cell splitting is the process of subdividing congested cells into smaller cells each with its own base stations and a corresponding reduction in antenna height and transmitter power. It increases the capacity of cellular system.

13. What is sectoring?

A: Sectoring is a technique for decreasing co-channel interference and thus increasing the system performance by using directional antennas.

14.Define co-channel reuse ratio?

A: Co-channel reuse ratio Q is given as Q = D/R, D – is the distance between centers of cells, R – radius of the hexagonal cell

15. Define Grade of Service?

A: Grade of Service in Wireless communication can be defined as ability of the user to connect on a call when the cell is being used by multiple users. It can be given by the ratio of number of blocked calls to the number of offered calls.

16.Write down the features of cellular concept?

The cellular concept was a major breakthrough in solving the problem of spectral congestion and user capacity. It offered very high capacity in a limited spectrum allocation without any major technological changes. The cellular concept is a system-level idea which calls for replacing a single, high power transmitter (large cell) with many low power transmitters (small cells), each providing coverage to only a small portion of the service area.

17.When does handoff occur?

A: Hand-off occurs when a received signal from its serving cell becomes weak and another cell site can provide a stronger signal to the mobile subscriber. If the new cellsite has some free voice channels then it assigns one of them to the handed-off call.

18.Differentiate soft and hard handoff?

Hard handoff	Soft handoff
It is characterized by a mobile having a radio link with only AP at any time.	The mobile can simultaneously communicate with more than one AP during the handoff.
Thus, the old connection is terminated before a new connection is activated. This mode of operation is referred to as break before make.	Thus, new connection is made before breaking the old connection, and is referred to as make before break.

19. What is meant by cell capacity?

A: Consider a cellular system with S duplex channels. Suppose each cell is allocated to K channels. Let these S channels be divided among N cells. (Cluster) S=KN If a cluster of N cell is replicated M times in the system, the total number of duplex channels C is the cell capacity C= MS= MKN

20. In a cellular network, among handoff call and a new call, which one is given as priority? Why?

A: Handoff calls are given higher priority over new calls. A new call occurs when a user requests a new connection, while a handoff occurs when an active user moves from one cell to other. Call dropping occurs when a call in progress is forcefully terminated due to lack of available sources in the new cell. On the other hand, Call blocking takes place when a new

call may not be served. Call dropping is less desirable than call blocking. Hence, Handoff calls are given higher priority over new calls.

UNIT-II MOBILE RADIO PROPAGATION

1.What is meant by link budget Equation/Friss Equation / Free space equation? (or) Give the equation for average large-scale path loss between transmitter and receiver as a function of distance?

A: A link budget is the clearest and the most intuitive way of computing the received power of the signal with respect to distance. (In other words) It is simply a link budget equation used to predict received signal strength, when unobstructed line of sight (LoS) path exists between transmitter and receiver over a larger distance.

$$P_r = \frac{P_t G_t G_r \lambda^2}{(4\pi d)^2}$$

Pr= Total Received Signal Power Pt= Transmitted Signal Power

Gt, Gr= Gain of the Transmitter and Receiver respectively.

λ = Wavelength of the Antenna d= distance between Transmitter and Receiver

2.Write the effects of fading?

➢ Rapid changes in signal strength over a small travel distance or time interval.

➢ Random frequency modulation due to varying Doppler shifts on different multipath signals

➢ Time dispersion caused by multipath propagation delays.

3.What is mean by fading? Bring out the significance and differences on its types ?

A: The time variation of received signal power due to changes in transmission medium or paths or obstacles is known as fading. Based on channel model parameters and position or movement of transmitter/receiver, there are two different fading types as mentioned below.

small scale fading	Large scale fading
•Small scale fading is concerned with rapid fluctuations of received signal strength over very short distance and short time period. •These multipath fading types depend on propagation environment. •It is divided into two main categories viz. multipath delay spread and doppler spread.	•Large scale fading occurs when an obstacle comes in between transmitter and receiver. This interference type causes significant amount of signal strength reduction. This is because EM wave is shadowed or blocked by theobstacle. It is related to large fluctuations of the signal over distance. • It includes path loss and shadowing effects

4.What are the factors influencing small scale fading and its causes?

A: The factors influencing small scale fading are Speed of surrounding objects, Multipath propagation, Speed of the mobile, Transmission bandwidth of the signal. And its causes were Random frequency modulation due to varying Doppler shifts on multipath signals and Time dispersion caused by multipath propagation delays.

5. What are Fresnel zones?

The concentric circles on the transparent plane located between a transmitter and receiver represent the loci of the origins of secondary wavelets which propagate to the receiver such that the total path length increases by λ/2 for successive circles. These circles are called **Fresnel zones.**

6.What is far field distance/ Franhoufer distance? Find the far field distance for an antenna with maximum dimension of 2m and operating frequency 1 GHz?

A: Franhoufer region of a transmitting antenna is defined as the region beyond the far field distance. If D is the largest linear dimension of the antenna, Far field distance Df is given by, Df= 2D2 / λ ; Df= 2D2 /λ= 2 * 2 * 2/0.3 ; Df= 26.7 m

7.What are the effects of multipath propagation?

A: The presence of reflecting objects and scatterers in the channel creates a constantly changing environment which can cause the following effects. Multiple versions of the transmitted signal can arrive at the receiver. Random phases and fluctuations lead to fading.It can also lead to Inter Symbol Interference. (ISI)

8. Calculate the Brewster Angle for a wave impinging on ground having a permittivity of

εr =5 ?

$$Sin\ \theta_B = \frac{\sqrt{\varepsilon_r - 1}}{\sqrt{\varepsilon_r^2 - 1}} = 0.409 \quad \text{Brewster Angle} = \sin^{-1}(0.409) = 24.14$$

9. Define coherence bandwidth?

Definition 1: The coherence bandwidth is related to the specific multipath structure of the channel. The range of frequencies over which the similar fading occurs is called coherence bandwidth.

Definition 2: The range of frequencies over which the two frequencies are having strong potential for amplitude correlation. It is inversely proportional to the rms delay spread of the channel.

$$B_c = \frac{1}{50\sigma_t}$$

10.What is coherence time? In what way does this parameter decide the behaviour of wireless channel?

A: Definition 1: The range of time over which the similar fading occurs is called coherence time.

Definition 2: The time over which signals are having strong potential for amplitude correlation. It is inversely proportional to the Doppler frequency of the channel.

$$T_c = \frac{1}{fm}$$

Coherence time definition implies that the two signals arriving with a time separation greater than Tc are affected differently by the channel.

11. Define Doppler shift/ Doppler frequency?

The relative moment between Mobile and Base station each multipath wave experiences an apparent shift in frequency. This shift is called the Doppler shift/ Doppler frequency. It is directly proportional to the velocity and spatial angle between the directions of the mobile with respect to the arrival of wave. It is denoted by

$$f_m = \frac{v}{\lambda}\cos\theta$$

12.Write the fading effects due to multipath spread, Doppler Spread?

A: Fading effects due to multipath spread

➢ Frequency Selective Fading

➢ Frequency non selective fading (Flat Fading)

Fading effects due to Doppler Spread:

➢ Time selective fading (Fast Fading)

➢ **Time Non selective fading (Slow Fading)**

13. What is Doppler spread?

A: It is a measure of spectral widening caused by the time rate of change of mobile radio channel and is defined as the range of frequencies over which the received Doppler spectrum **is essentially non-zero.**

14. What is flat fading?

A: If the mobile radio channel has a constant gain and linear phase response over a bandwidth which is greater than the bandwidth of the transmitted signal, then the received signal will undergo flat fading. If channel bandwidth is greater than coherence bandwidth then flat fading will occur.

15. What is frequency selective fading?

A: If the channel possesses a constant gain and linear phase response over a bandwidth that is, smaller than the bandwidth of transmitted signal, then the channel creates frequency selective fading on the received signal. Bsignal>Bcoherence.

16. Write the difference in conditions for flat fading and frequency selective fading?

flat fading	frequency selective fading
BW of signal<<BW of channel Symbol period>>Delay spread	Bandwidth of Signal> Coherence Bandwidth Symbol period< Delay spread

17. Define fast fading channel?

A: The channel impulse response changes rapidly within the symbol duration. If the time duration of signal is greater than coherence time then fading will occur very fastly. This type of channel is called fast fading channel.

18. Define slow fading channel?

A: The channel impulse response changes at a rate much slower than the transmitted baseband signal. If the time duration of signal is less than coherence time then fading will occur very fastly. This type of channel is called slow fading channel.

19. Write the conditions for fast and slow fading?

A: Fast fading: Time duration of Signal> Time duration of Channel (Tsignal>Tcoherence)

Slow fading: Time duration of Signal< Time duration of Channel (Tsignal<Tcoherence)

20. What is the major advantage of wireless communication?

Wireless communication has several advantages with the following being some of the

most important: Cost effectiveness, Flexibility, Convenience, Constant connectivity.

UNIT- III MODULATION TECHNIQUES AND EQUALIZATION AND DIVERSITY

1.Define Digital modulation?

A:Digital Modulation is nothing but mapping the digital data into the analog waveform for transmitting the signal via channel. E.g.: Binary Modulation (two bits), M-ary Modulation.

2. What is demodulation?

A: It is the process of recovering the original modulating signal (Digital data) from a modulated signal.

3. Write the advantages of digital over analog modulation?

A: •Spectral Efficiency is high.

•Adjacent Channel Interference is low.

•Greater noise immunity,

•Robustness to channel impairments

•Easier multiplexing of various forms of information and Greater security.

4.What is MSK? What is the advantage of MSK over QPSK?

A: MSK is a special type of continuous phase frequency shift keying wherein the peak frequency deviation ratio is ¼ th of bit rate. Modulation index of MSK is 0.5. In QPSK the phase changes by 90 or 180 degrees. This creates abrupt amplitude variations in the waveform. Therefore bandwidth requirement of QPSK is more. MSK overcomes this problem. In MSK, the output waveform is continuous in phase hence there are no abrupt changes in amplitude.

5. Why MSK is called as fast FSK? Mention some merits of MSK?

A:MSK is called fast FSK, as the frequency spacing used is only half as much as that used in conventional non-coherent FSK.

Merits:

• Constant envelope,

• Self-synchronizing capability,

• Spectral efficiency,

• Good BER performance.

6. Why MSK cannot be directly used in multi user communications?

• The main lobe of MSK is wide. This makes MSK unsuitable for the applications where extremely narrow bandwidths and sharp cut-offs are required.

• Slow decay of MSK power spectral density curve creates adjacent channel interference. Hence MSK cannot be used for multiuser communications.

7. What is the need of Gaussian filter in GMSK?

A: • Gaussian filters are used to reduce the transmitted bandwidth of the signal.

• Gauss Filters smooth the phase trajectory of MSK signal and stabilises the instantaneous frequency variation over time.

• Thus reduces the side lobe levels.

8. What is GMSK? What are the advantages and disadvantages of GMSK?

A: GMSK is a derivative of MSK. The side lobe levels of the spectrum are further reduced by passing a modulating NRZ data to the Gaussian Pulse Shaping Filter. Advantages: GMSK has high power efficiency. GMSK has high spectral efficiency. Disadvantages: Gaussian filter introduces the ISI in the transmitted signal. But the degradation is not severe when Bandwidth-time product (BT) is greater than 0.5.

9.What are the factors used in adaptive algorithms?

A: • Rate of convergence,

• Misadjustment,

• Computational complexity

• Numerical properties.

10. What is the need of equalization?

• Equalization is used to compensate the inter-symbol interference created by multipath environment.

• An equaliser within a receiver compensates the average range of expected channel impulse response amplitude and delay characteristics.

• Equaliser should be adaptive since the channel is unknown and time varying.

11. What is diversity and mention the types of diversity?

A: Transmitting the same information across independent fading channels is called diversity.

1.Spatial diversity 2.Antenna diversity 3.Frequency diversity 4.Time diversity 5.Polarization diversity

12. Write the functions of diversity?

A:• Diversity is used to compensate for fading channel impairments, and is usually implemented by using two or more receiving antennas. • Diversity improves transmission

performance by making use of more than one independently faded version of the transmitted signal.

13. What is training mode in an adaptive equalizer?

A: First, a known fixed length training sequence is sent by the transmitter, then the receiver's equalizer may adapt to a proper setting of minimum bit error rate detection. Those training sequence is pseudorandom binary signal or a fixed and prescribed bit pattern. Training sequence permits the equaliser to acquire filter coefficients under worst channel conditions.

14.What is the need for diversity schemes?

A: ❖ To increase signal to noise ratio

❖ To degrade the bit error Probability

❖ For High Immunity of fading

15. Explain Diversity concept?

A: If one radio path undergoes a deep fade, another independent path may have a strong signal. By having more than one path to select from, both the instantaneous and average SNRs at the receiver may be improved.

16. Define spatial diversity?

A: The most common diversity technique is called spatial diversity, whereby multiple antennas are strategically spaced and connected to a common receiving system. While one antenna sees a signal null, one of the other antennas may see a signal peak, and the receiver is able to select the antenna with the best signals at any time.

17 Differentiate between Macro diversity and Micro diversity?

Macro diversity	Micro diversity
It is suitable for large scale fading channels.	It is suitable for small scale fading channels
It is caused by shadowing due to variation in both the terrains and nature of surroundings	It is caused by multiple reflections from the surroundings in the vicinity of the mobile.
These antennas are located on the vehicle or at the same base station tower and their spacing is a few wavelengths. The received signal amplitude is correlated, depending on the antennas separation *d* relative to the wavelength.	Signals from within a cell may be received at the different corners of the hexagonal area. The advantage is that not only the multipath fading attenuation is independent at each branch but that the shadowing and path losses are also uncorrelated to some extent

18. State the principle of diversity?

A: Diversity: It is the technique used to compensate for fading channel impairments. It is implemented by using two or more receiving antennas. While Equalization is used to counter the effects of ISI, Diversity is usually employed to reduce the depth and duration of the fades experienced by a receiver in a flat fading channel. These techniques can be employed at both base station and mobile receivers. Spatial Diversity is the most widely used diversity technique.

19.Define spread spectrum?

A: spread-spectrum techniques add redundancy means it uses **extended bandwidth** to accommodate signals in a protective envelope so that more secure transmission is possible. The spread code is a series of numbers that looks random but are actually a pattern. The original bandwidth of the signal gets **enlarged** (spread) through the spread code.

20. Define pseudo noise sequence?

A: A coded sequence of 1s and 0s with specific autocorrelation properties is known as a pseudo-noise (PN) sequence.

Both the transmitter and receiver are informed of the PN sequence, which is a deterministic, periodic signal. The signal appears to have the statistical properties of sampled white noise since the signal is deterministic. Thus to an unauthorized listener, it appears as a random signal.

UNIT- IV MULTIPLE ACCESS TECHNIQUES

1. Give the uses of Multiple access techniques ?

A: 1. It shares many users at same time
2. share a finite amount of radio spectrum
3. high performance
4. duplexing generally required
5. It works in frequency domain
6. It also works in time domain

2. What do you mean by narrow band and wide band system?

A: **NARROW BAND SYSTEM**
1. *Channel system:* generally total spectrum is divided into a number of relatively narrow radio channels (e.g. FDMA). If all the channels are being used, call blocking occurs. Unused bandwidth in each channel cannot be used by other users.
2. Transmission experiences non selective fading. This means that when fading occurs, whole of the information (i.e. the whole channel) is affected.

WIDE BAND SYSTEM
1. The main feature of wide band systems is that either complete spectrum is available (e.g. CDMA, TDMA) or a considerable portion of it is used by each user (e.g. TDMA+FDMA).
2. The advantage of wideband systems is that the transmission bandwidth always exceeds the coherence bandwidth for which the signal experiences only selective fading. That is, only a small fraction of the frequencies composing the signal is affected by fading.
3. Signal can be distorted and therefore equalization is needed but unlikely a total signal fade occurs.

3. Write the types of Multiple Access Techniques?

A: Types of multiple access techniques are:
1. Frequency division multiple access **(FDMA)**
2. Time division multiple access **(TDMA)**
3. Code division multiple access **(CDMA)**
4. Space division multiple access **(SDMA)**
They all are grouped as narrow band and wide band system.

4.What is the difference between Multiple Access & Multiplexing?

A: Both are very different terms.
1. Multiplexing is the process of transmitting several messages simultaneously on the same circuit or channel.
On the other hand Multiple Access are techniques that have been developed in the satellite industry which allow satellite spectrum and power to be shared efficiently among multiple users.

2. In multiple access, more than one simple signal can thus be transmitted as part of a single complex signal and separated out at the receiving end. This is not possible in multiplexing.

5. What is Near Far Problem?

A: At the receiver, the signals may come from various multiple sources.
1. The strongest signal usually captures the modulator. The other signals are considered as noise.
2. Each source may have different distances to the base station

6. What is Duplexing?

A: For voice or data communications, must assure two way communication (duplexing, it is possible to talk and listen simultaneously). Duplexing may be done using frequency or time domain techniques.
1. Forward (downlink) band provides traffic from the BS to the mobile
2. Reverse (uplink) band provides traffic from the mobile to the BS.

7. Write the features of TDMA?

Time Division Multiple Access Technique

A: TDMA is Time Division Multiple Access technique, its features are:
1. In TDMA a single carrier frequency with a wide bandwidth is shared among multiple users. Each user is assigned non-overlapping time slot.
2. Number of time slots per frame depends on (1) available bandwidth, (2) modulation techniques etc.
3. Transmission for TDMA users is not continuous, but occurs in bursts, resulting in low battery consumption. The subscriber transmitter may be turned off during non-transmission periods.

8.What is CDMA?

A: CDMA is Code Division Multiple Access Technique.
1. For code-division multiple access, each transmitter is assigned a different pseudo-noise (PN) sequence.
2. If possible, orthogonal sequences should be used.
3. The PN sequence for the transmitter is only given to the receiver that is to operate with the transmitter.
4. The receiver will then only receive the correct signals and ignore all others.

9. What is the fundamental difference between analog and digital modulation in wireless communication?

A: The fundamental difference between analog and digital modulation is that analog modulation encodes continuous analog signals, while digital modulation encodes discrete digital data into a waveform. Analog modulation varies a carrier signal's amplitude,

frequency, or phase to transmit information, while digital modulation represents data as discrete symbols, such as binary bits, and modulates the carrier accordingly.

10. Compare and contrast simplex, half-duplex, and full-duplex communication modes in wireless networks.

A: Simplex Communication: In simplex mode, communication occurs in only one direction. One device can only transmit, and the other can only receive. Examples include TV broadcasting.

Half-Duplex Communication: In half-duplex mode, communication can occur in both directions, but not simultaneously. Devices take turns transmitting and receiving. Examples include walkie-talkies.

Full-Duplex Communication: Full-duplex mode allows simultaneous two-way communication. Devices can transmit and receive data at the same time, improving efficiency. Examples include cell phone calls.

11: What is the purpose of multiple access techniques in wireless communication? Provide an example of a multiple access technique and briefly explain how it works.

A: Multiple access techniques are used in wireless communication to enable multiple users or devices to share the same communication medium simultaneously. One example is Frequency Division Multiple Access (FDMA), where the available frequency spectrum is divided into non-overlapping frequency bands. Each user or channel is assigned a unique frequency band, and they can transmit simultaneously without interference since they operate in separate frequency ranges. FDMA is commonly used in analog communication systems like FM radio broadcasting

12.Explain the concept of Time Division Multiple Access (TDMA) in wireless communication and mention one advantage of using TDMA.

A: TDMA is a multiple access technique where the available time slots in a communication channel are divided into smaller time intervals. Each user is assigned a specific time slot during which they can transmit data. An advantage of TDMA is efficient spectrum utilization, as multiple users can share the same frequency band by taking turns in the time domain.

13.Compare the advantages of FDMA, TDMA, and CDMA in wireless communication. Provide one distinct advantage for each technique.

- FDMA Advantage: Efficient spectrum allocation - Each user gets a dedicated frequency band, minimizing interference.
- TDMA Advantage: Efficient time utilization - Users share the same frequency band but transmit in separate time slots, maximizing channel capacity.

- CDMA Advantage: Robust against interference - CDMA spreads signals across a wide bandwidth, making it resilient to narrowband interference.

14.What is the key advantage of Frequency Division Multiple Access (FDMA) over Time Division Multiple Access (TDMA) in wireless communication?

A: The key advantage of FDMA over TDMA is that FDMA provides continuous access to the allocated frequency band for each user, ensuring consistent and uninterrupted communication. In TDMA, users share the same frequency band but take turns in time slots, which can introduce latency and may not guarantee continuous access.

15. Explain the concept of spatial division multiple access (SDMA) in wireless communication. How does it improve capacity and efficiency?

A: SDMA is a multiple access technique that leverages the spatial dimension (space) to improve capacity and efficiency. It allows multiple users to transmit simultaneously on the same frequency band by using multiple antennas. SDMA exploits the fact that signals from different antennas experience different spatial characteristics, such as path loss and fading. By using beamforming or spatial multiplexing, SDMA can separate and decode signals from different users, thereby increasing capacity and reducing interference.

16. Describe the concept of the Aloha protocol in wireless communication. What is the main limitation of pure Aloha, and how does it relate to contention-based access?

A: The Aloha protocol is a contention-based multiple access technique used in wireless communication. In pure Aloha, devices can transmit data whenever they have it, without prior coordination. The main limitation of pure Aloha is that it does not check for collisions before transmission. As a result, collisions can occur when multiple devices transmit simultaneously, leading to data loss and inefficiency. Contention-based access protocols like Aloha are suitable for scenarios with low traffic loads.

17. In Code Division Multiple Access (CDMA), how does the use of unique spreading codes for each user enable multiple access on the same frequency band?

A: CDMA enables multiple access by assigning a unique spreading code to each user. These spreading codes are orthogonal to each other, meaning they have minimal interference with one another when overlaid on the same frequency band. When a user transmits data, their signal is spread using their specific code. At the receiver, the demodulation process involves multiplying the received signal by the corresponding code, effectively separating the desired signal from other users' signals. This allows multiple users to share the same frequency band without mutual interference.

18. What role does the Medium Access Control (MAC) layer play in wireless communication, and why is it crucial for efficient multiple access?

A: The Medium Access Control (MAC) layer is responsible for managing access to the shared communication medium in wireless networks. It plays a crucial role in ensuring efficient multiple access by coordinating access among multiple users and devices. The MAC layer enforces rules and protocols for accessing the medium, such as time slots, contention periods, or channel access procedures. It helps prevent collisions, allocates resources, and optimizes channel utilization, ultimately improving the efficiency and reliability of wireless communication.

19.What is the fundamental difference between Frequency Division Multiple Access (FDMA) and Code Division Multiple Access (CDMA)? Provide a brief comparison of these two multiple access techniques.

A: The fundamental difference between FDMA and CDMA is in how they allocate resources:

- FDMA allocates unique frequency bands to different users.
- CDMA assigns unique codes to different users, allowing them to share the same frequency band.

FDMA divides the frequency spectrum, while CDMA spreads signals over the entire spectrum using unique codes.

20. What is the purpose of the guard band in Frequency Division Multiple Access (FDMA)? How does it contribute to interference mitigation?

A: The guard band in FDMA is a small frequency gap left unused between adjacent frequency channels. Its purpose is to prevent interference between channels by providing a buffer zone. The guard band helps mitigate interference by ensuring that signals from one channel do not spill over into adjacent channels, which can degrade the quality of communication. It improves the isolation between channels and enhances the overall reliability of the system.

Unit V: Wireless Networking

1.What is a wireless network?

A: A wireless network is a communication network that uses wireless data connections to connect devices, such as computers, smartphones, or IoT devices, to the internet or other networks without the need for physical cables.

2: What is Wi-Fi, and how does it work?

A: Wi-Fi is a wireless networking technology that allows devices to connect to a local area network (LAN) or the internet using radio waves. It operates by transmitting data between devices and a Wi-Fi router or access point.

3: What is the main advantage of a wireless LAN (Wi-Fi) over a wired LAN?

A: Mobility and Flexibility: Wi-Fi allows users to connect to the network without being tethered to a specific location by physical cables. This means that users can move freely within the coverage area of a wireless access point (AP) and maintain network connectivity. In contrast, wired LANs require users to stay connected through fixed Ethernet cables, limiting their mobility.

1. **Ease of Deployment:** Setting up a wired LAN involves the installation of Ethernet cables, which can be time-consuming and challenging, especially in existing buildings. Wi-Fi, on the other hand, requires minimal physical infrastructure. You only need access points strategically placed to provide wireless coverage, making it easier and more cost-effective to deploy, especially in dynamic or temporary environments.
2. **Scalability:** Expanding a wired LAN often involves significant effort and costs to lay additional cables and install new ports. In contrast, scaling a Wi-Fi network is relatively simple. You can add more access points to extend coverage or accommodate more users, making it highly scalable to meet evolving needs.

4: What is the purpose of a firewall in wireless networking, and how does it enhance security?

A: A firewall is a network security device that monitors and filters incoming and outgoing network traffic. It enhances security in wireless networking by controlling data flow and protecting against unauthorized access, malware, and other threats**.**

5. What is the concept of Quality of Service (QoS) in wireless networking, and why is it important?

A: Quality of Service (QoS) refers to the ability of a network to prioritize and manage data traffic to ensure that certain applications or services receive preferential treatment. It is important for maintaining the performance and reliability of critical applications over wireless networks.

6.What is a router in a wireless network, and what role does it play?

A: In a wireless network, a router is a crucial networking device that plays a central role in facilitating communication between devices within the network and connecting the network to the internet. Here's a more detailed explanation of what a router is and the roles it plays:

1. Device Connection: A router acts as a central hub that connects various devices within a home or office network. These devices can include smartphones, laptops, tablets,

desktop computers, smart TVs, IoT devices, and more. The router provides a point of access for all these devices to communicate with each other.

2. Internet Connectivity: One of the primary functions of a router is to connect the local network to the internet. It does this by receiving data from devices within the local network and forwarding it to the appropriate destination on the internet, and vice versa. Routers typically have a Wide Area Network (WAN) port that connects to an Internet Service Provider (ISP) modem.

3. Network Address Translation (NAT): Routers employ a feature called Network Address Translation (NAT) to map multiple local IP addresses (used within the local network) to a single public IP address (used on the internet). This allows multiple devices within the local network .

7.What is the purpose of the MAC (Media Access Control) address in wireless networking?

A: The MAC address in wireless networking serves as a unique hardware identifier for network interface cards (NICs) or wireless adapters. It is used to distinguish and address individual devices within a local network, enabling data packets to be directed specifically to the intended recipient device.

8.Explain the concept of "roaming" in wireless networks?

A: Roaming refers to the ability of a wireless device to maintain a continuous connection while moving from one access point to another within a wireless network. This allows devices to switch between different access points seamlessly, ensuring uninterrupted connectivity.

9.What is the difference between "2.4 GHz" and "5 GHz" frequency bands in Wi-Fi?

A: The main difference is in the frequency and bandwidth. The 2.4 GHz band offers better range but is more susceptible to interference, while the 5 GHz band provides faster data rates but has a shorter range and may be less congested in environments with many devices.

10.Name the levels in AIN architecture?

A: AIN Architecture consists of three levels

(i) Intelligent level
(ii) Transport level
(iii) Access level

11.what is circuit switching?

A: Circuit switching is a communication method where a dedicated communication path, or circuit, is established between two devices before data transmission begins. The circuit remains dedicated to the communication for the duration of the session, and no other devices

can use it while the session is in progress. Circuit switching is commonly used in voice communication and some types of data communication.

12. what is packet switching?

A: Packet switching is a communication method where data is divided into smaller units called packets and transmitted over the network. Each packet contains the source and destination addresses, as well as other information needed for routing. The packets may take different paths to reach their destination, and they may be transmitted out of order or delayed due to network congestion.

13. what do you mean by virtual-circuit approach?

A: Virtual Circuit is the computer network providing connection-oriented service. It is a connection-oriented network. In virtual circuit resource are reserve for the time interval of data transmission between two nodes. This network is a highly reliable medium of transfer. Virtual circuits are costly to implement.

14. write the objective of pcs/pcn?

A: The objective of personal communication systems (PCS) or personal communication networks (PCNs) is to provide ubiquitous wireless communications coverage, enabling users to access the telephone network for different types of communication needs, without regard for the location of the user or the location of the information being accessed.]

15.define prma?

A: PRMA is a multiple access scheme with frames of a fixed number of slots. If a terminal has a series of data packets (or speech segments) to transmit, it competes for access in any free slot. If it successfully captures the base station, the terminal gains reservation in the corresponding slots of the next frames, until it releases the reservation.In PRMA, adjacent cells use different carrier frequencies according to a cellular reuse plan.

16.what do you mean by umts?

A: Universal mobile telecommunication system (UMTS) is defined as the third-generation (3G) mobile network built on the global UMTS is popularly known as a third-generation (3G) cellular network. It was seen as a better cellular technology for data transfer than its predecessor, the GSM technology, which used GPRS and EDGE data services, primarily due to its speed of transfer and operation. GSM standard, compatible with data transfer up to 2 Megabits per second.

17. List out the features of UMTS?

A: **Features of UMTS**

- UMTS could be a component of IMT-2000 standard of the Universal Broadcast communications Union (ITU), created by 3GPP.

- It employments wideband code division multiple access (W-CDMA) discuss interface.
- It gives transmission of content, digitized voice, video and multimedia.
- It gives tall transmission capacity to portable operators.
- It gives a tall information rate of 2Mbps.

18. List out the advantages of packet switching than circuit switching?

A: Advantages of packet switching over circuit switching:

- More efficient than circuit switching
- Data packets are able to find the destination without the use of a dedicated channel
- Reduces lost data packets because packet switching allows for resending of packets
- More cost-effective since there is no need for a dedicated channel for voice or data traffic.

19. what do you mean by connection- oriented routing?

A: Connection-oriented service is related to the telephone system. It includes connection establishment and connection termination. In a connection-oriented service, the Handshake method is used to establish the connection between sender and receiver.

20. what is meant by datagram approach?

A: A packet-switching technology in which a packet exists is called a datagram. It is treated as a separate entity. Each packet includes data about the destination, and the switch helps this data forward the packet to the right destination. It is also known as connectionless switching.