



QUESTION BANK

UNIT-1

THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS

PART-A

1. What are the different types of services in wireless communication?

Broadcast paging, cellular telephony, trucking radio, cordless telephony, WLANs and personal area networks, fixed wireless access and satellite cellular communications.

2. What is the difference between broadcast TV and satellite TV?

In satellite TV, the transmissions are intended only for a subset of all possible users. Therefore, encryption of the content is required to prevent unauthorized viewing.

3. What are the characteristics of cellular telephony?

The information flow is bi-directional; the user can be anywhere within a network; A call can originate from either the network or the user; the location of a user can change significantly during a call

4. What is the difference between cordless telephony and cellular phone?

The cordless telephone is associated with only a single base station. There is no MSC. The base station is directly connected to the PSTN.

5. What are the basic requirements of wireless services?

Data rate, Range, Mobility, Energy consumption, Use of spectrum, Direction of transmission and Service quality.

6. What is meant by multipath propagation?

The signal can get from the TX to the RX via a no. of different propagation paths. The signal gets reflected and diffracted by different objects. So each of the paths has a distinct amplitude, delay and direction of arrival. This effect is known as multipath propagation.

7. What is meant by small and large scale fading?

- The rapid fluctuations of the amplitudes, phases; or multipath delays of a radio signal over a short period of time or travel distance is known as small scale fading.
- The rapid fluctuations of the amplitudes, phases, or multipath delays of a radio signal over a long period of time or travel distance is known as large scale fading.

8. What is ISI?

Inter symbol interference (ISI) is a form of distortion of a signal in which one symbol interferes with subsequent symbols.

9. What are the different types of multiple access schemes?

FDMA-Frequency division multiple access-different frequencies are assigned to different users

TDMA-Time division multiple access-different time slots are assigned to different users.

CDMA-Code division multiple access-each user is assigned a different code.

10. What are the advantages and disadvantages of FDMA?

Advantages:

The transmitter and receiver require much less digital signal processing, Synchronization is simple.

Disadvantages:

1. Sensitivity to fading
2. Sensitivity to random frequency modulation
3. Inter modulation

11. What is slotted and un-slotted ALOHA?

The BS prescribes a certain slot structure. Each TX has a synchronized clock that makes sure that the start of the transmission time coincides with the beginning of a slot. Thus partial collisions cannot occur anymore. If the starting time of packet transmission is chosen completely at random by the transmitter, then the system is called un-slotted ALOHA.

12. What is meant by carrier sense multiple access (CSMA)?

A transmitter can determine whether the channel is currently occupied by another user. This knowledge can be used to increase the efficiency of a packet switched system. If one user is transmitting, no other user is allowed to send a signal. Such a method is called CSMA.

13. What is meant by CSMA with collision detection?

In this method, a node observes whether two transmitters start to transmit simultaneously. If so, transmission is immediately terminated.

14. What is meant by data sense multiple access?

In this approach, the downlink includes a control channel, which transmits at periodic intervals a busy/available signal that indicates the state of the channel. If a user finds the channel to be free, it can immediately send off a data packet.

15. Classify the routing methods.

- Source driven routing-the header of the packet includes the complete route, and the nodes just follow the instructions for forwarding. The drawback is that the header can become quite long, especially for packets with little payload. This leads to a decrease in spectral efficiency.
- Table driven routing- each node stores in a table the nodes to which it should forward packets. This method has better spectral efficiency.

16. Define frequency reuse distance.

It is defined as the distance between two cells that can use the same frequency channels.

17. What is cluster? What is its significance?

Cluster is a group of cells that all use different frequencies. No co channel interference within such a cluster. The cluster size also determines the capacity of the cellular system.

18. What is meant by frequency reuse or frequency planning?

By limiting the coverage area to within the boundaries of a cell, the same group of channels may be used to cover different cells that are separated from one another by distances large enough to keep interference levels within tolerable limits. This design process of selecting and allocating channel groups for all of the cellular base stations within a system is called frequency reuse.

19. Give an expression for capacity of a system.

$C = \frac{MKN}{S}$ where M= no. Of clusters, N= no of cells, K= no of channels in a cell, S= total no of available radio channels.

20. What must we do to find the nearest co-channel neighbors?

No of cells per cluster is given by $N=i^2+ij+j^2$.

To find the nearest co-channel neighbors of a particular cell, we must do Move i cells along any chain of hexagons and then Turn 60 degrees counter-clockwise and move j cells.

21. What are the different methods available to increase the capacity of the system?

Increasing the amount of spectrum used, more efficient modulation format and coding, discontinuous transmission, multi user detection, reduction of cell radius, use of sector cells and multiple antennas.

22. What are the factors influencing small scale fading?

Speed of surrounding objects, Multipath propagation, Speed of the mobile, Transmission bandwidth of signal.

23. What is frequency hopped multiple access?

Frequency Hopping Multiple Access (FHMA)is a spread-spectrum transmission technology, which permits simultaneous voice or data communications to share the exact same communication medium.

24. What are the different modules of basic cellular system?

Mobile stations, base stations, and a mobile switching center (MSC).

25. State advantages of CDMA over FDMA.(Dec2014)

CDMA are used for digital, FDMA are used for analog. CDMA is much more efficient due to compression and the way that it sends the signal. CDMA does not need to send a signal, taking up space, when you are not talking, but FDMA does.

PART -B

1. Explain in detail the different types of services in wireless communication?
2. Discuss briefly about the requirements of services for a wireless system.
3. Compare and contrast wired and wireless communication
4. Describe the technical challenges to wireless communication
5. Explain *Inter symbol Interference* is caused and how it is eliminated
6. What is frequency Reuse? How this is used in GSM Cellular network?
7. Discuss different techniques used for improving coverage and capacity in cellular systems.
8. With neat diagrams explain TDMA& FDMA.
9. Explain about noise and interference limited system.
10. Write short notes channel assignment.
11. Explain the different hand off strategies used in wireless communication.

UNIT-II

MOBILE RADIO PROPAGATION

PART-A

1. What are the three basic propagation mechanisms?

The three basic propagation mechanisms which impact propagation in a mobile communication system are 1.Reflection2.Diffraction3.Scattering

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. Define coherence bandwidth and coherence timer.

The coherence bandwidth is related to the specific multipath structure of the channel. The coherence bandwidth is a measure of the maximum frequency difference for which signals are still strongly correlated in amplitude. This band width is inversely proportional to the rms value of time delay spread. The coherence timer is defined as the required time interval to obtain an envelope correlation of 0.9 or less.

4. Define Doppler shift and Doppler spread.

The shift in received signal frequency due to motion is called the Doppler shift.

The Doppler spread is defined as the range of frequencies over which the received Doppler spectrum is essentially non-zero.

5. What are the effects of multipath propagation?

Slow fading and fast fading

6. What is flat fading? Write its conditions.

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.

Conditions: $BW \text{ of signal} \ll BW \text{ of channel } B_s \ll B_c$; Symbol period \gg Delay spread $T_s \gg \sigma$

7. What is frequency selective fading? Write its conditions.

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.

Conditions: $BW \text{ of signal} > BW \text{ of channel } B_s > B_c$; Symbol period $<$ Delay spread $T_s < \sigma$

8. Define fast fading channel and slow fading channel.

The channel impulse response changes rapidly within the symbol duration. This type of channel is

called fast fading channel. The channel impulse response changes at a rate much slower than the transmitted base band signal. This type of channel is called slow fading channel.

9. What is meant by time dispersion and frequency dispersion?

The received signal has a longer duration than that of the transmitted signal, due to the different delays of the signal paths. This is known as time dispersion. The received signal has a larger bandwidth than that of the transmitted signal, due to the different Doppler shifts introduced by the components of the multipath. This is known as frequency dispersion.

10. Classify the wireless channels.

Time-flat channels, Frequency-flat channels, Frequency-selective channels

11. What is the need of propagation model?

Propagation models have traditionally focused on predicting the average received signal strength at a given distance from the transmitter, as well as the variability of the signal strength in close spatial proximity to a particular location. Propagation models that predict the mean signal strength for an arbitrary transmitter-receiver separation distance are useful in estimating the radio coverage area of a transmitter.

12. What is free space propagation model?

It is a model which is used to predict received signal strength, when unobstructed line of sight path between transmitter and receiver.

13. 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 $\lambda/2$ for successive circles. These circles are called Fresnel zones.

14. Explain knife-edge diffraction model.

Knife edge is the simplest of diffraction models, and the diffraction loss can be readily estimated using the classical Fresnel solution for the field behind the knife edge.

15. What is the need of path loss models in link budget design?

The path loss models are used to estimate the received signal level as the function of distance it becomes possible to predict the SNR for a mobile communication system.

16. Define Snell's law.

Snell's law states that the ratio of the sines of the angles of incidence and refraction is equivalent to the ratio of phase velocities in the two media, or equivalent to the reciprocal of the ratio of the indices of refraction:

$$\frac{\sin \theta_1}{\sin \theta_2} = \frac{v_1}{v_2} = \frac{n_2}{n_1}$$

17. What are the three most important effects due to multipath in mobile radio channel?

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.

18. State the difference between Narrow band and Wide band systems?

Narrow band	Wide band
For a narrowband channel, the impulse response is a delta function with a time-varying attenuation	The most commonly used wide band model is an N -tap Rayleigh-fading model
The variations in amplitude over a small area are typically modeled as a random process, with an autocorrelation function that is determined by the Doppler spectrum	This is a fairly generic structure, and is basically just the Tapped delay line structure with the added restriction that the amplitudes of all taps are subject to Rayleigh fading.

19. State the difference between small scale and large scale fading?

Small scale fading	Large scale fading
The rapid fluctuations of the amplitudes, phases; Or multipath delays of a radio signal over a short period of time or travel distance is known as small scale fading.	The rapid fluctuations of the amplitudes, phases, or Multi path delays of a radio signal over along period of time or travel distance is known as large scale fading.

20. Differentiate Fast fading & slow fading.

Fast Fading	Slow Fading
1. High Doppler spread.	1. Low Doppler Spread.
2. Coherence time is lesser than symbol period.	2. Coherence time is greater than symbol period.
3.Channel variations faster than base band signal Variations.	3.Channel variations slower than base band signal Variations.

21. State the propagation effects in mobile radio.

The type of fading experienced by a signal propagating through a mobile communication channel depends on the nature of the transmitted signal with respect to the characteristics of the wireless channel.

Fading effects in a mobile environment can be classified as

1. Fading effects due to multiple path time delay spread.
2. Fading effects due to Doppler spread.

22. Interpret link budget equation.

A link budget equation: $P_{rx} = P_{tx} + G_{tx} - L_{tx} - L_{fs} - L_m + G_{rx} - L_{rx}$

23. What are the different fading effects due to Doppler spread?

Fast fading and slow fading.

PART-B

1. With neat diagrams explain the Free Space Propagation Model?
2. Derive the equation of the Path loss using Two-Ray Model with neat diagrams
3. Explain knife Edge Diffraction Model
4. Derive the Impulse response model of a Multipath channel.
5. What is small scale fading? What are the factors influencing small scale fading?
6. Explain detail about type of small scale fading?
7. Explain Clarke's model for flat fading?
8. Explain different propagation mechanism
9. Explain the wideband channel models
10. Explain different types of wide band and narrow band models

UNIT-III

MODULATION TECHNIQUES AND EQUALIZATION

PART-A

1. Write the advantages of digital over analog modulation.

Greater noise immunity, robustness to channel impairments, easier multiplexing of various Forms of information, Greater security

2. What is meant by Amplitude shift keying and Frequency shift keying?

If amplitude of the carrier is varied depending on the incoming digital signal, then it is called Amplitude shift keying. If the frequency of the sinusoidal carrier frequency is varied depending on the incoming digital signal, then it is called Frequency shift keying.

3. What is meant by Phase shift keying (PSK) and Quadrature Phase shift keying (QPSK)?

If phase of the carrier is varied depending on the input digital signal, then it is called phase shift keying. QPSK is a multi level modulation in which four phase shifts are used for representing four different symbols.

4. Define M-ary transmission system.

In digital modulation instead of transmitting one bit at a time, two or more bits are transmitted simultaneously. This is called M-ary transmission.

5. What is Quadrature modulation and Quadrature amplitude modulation?

Sometimes two or more Quadrature carriers are used for modulation. It is called Quadrature modulation. Quadrature amplitude modulation (QAM) is in which both the amplitude and phase of the transmitted signals are varied by the baseband signal by ASK and PSK combination in order to minimize the errors in the received data.

6. Explain the following terms a) Baud rate b) Bit rate

Baud rate: Speed at which symbols are transmitted in a digital communication system, ie., no of symbols/second.

Bit rate: Speed at which data bits is transmitted in a digital communication system, ie no of bits/sec.

7. What is linear modulation and non linear modulation?

In linear modulation technique, the amplitude of the transmitted (carrier) signal varies linearly with the modulating digital signal. In general, linear modulation does not have a constant envelope. In non linear modulation, the amplitude of the carrier is constant regardless of the variation in the modulating signal.

8. Mention the merits and demerits of non linear modulation.**Merits:**

1. Lower efficient class c amplifiers can be used without introducing degradation in the spectrum occupancy of the transmitted signal.
2. Low out of band radiation of the order of -60dB to -70dB can be achieved.
3. Limiter -discriminator detection can be used, which simplifies receiver design and provides high Immunity against random FM noise and signal fluctuations due to Rayleigh fading.

Demerits:

1. Constant envelope modulations occupy a larger bandwidth than linear modulation scheme
2. In situations where bandwidth efficiency is more important than power efficiency, constant envelope modulation is not well suited.

9. What is the advantage of MSK over QPSK?

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.

10. Why MSK is called as fast FSK?

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

11. Mention some merits of MSK.

Constant envelope, Spectral efficiency, Good BER performance, Self-synchronizing capability

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

1. The main lobe of MSK is wide. This makes MSK unsuitable for the applications where

extremely narrow bandwidths and sharp cut-offs are required.

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

13. What is the need of Gaussian filter? (Dec 2013)

Gaussian filters used before the modulator to reduce the transmitted bandwidth of the signal. It uses less bandwidth than conventional FSK.

14. Give some examples of linear modulation.

Pulse shaped QPSK, OQPSK, $\pi/4$ QPSK

15. Give some examples for constant envelope modulation.

BFSK, MSK, GMSK

16. Define M-ary FSK.

In M-ary system, $M=2^N$ different symbols are used and N no of bits per symbol. Every symbol uses separate frequency for transmission.

17. Write the applications of MFSK and OFDM.(June 2012)

They are used for high speed data connections as part of the IEEE 802.11a standards activities to provide 54mbps WLAN connections, as well as for high speed line of sight and non line of sight connections for Multi channel Multipoint Distribution service (MMDS) operation.

18. What are the modulations suitable for frequency selective mobile channels?

Both filtered and unfiltered BPSK, QPSK, OQPSK and MSK modulations are suitable.

19. Mention any two criteria for choosing a modulation technique for a specific wireless application?

The spectral efficiency of the modulation format should be as high as possible. This can best be achieved by a higher order modulation format. This allows the transmission of many data bits with each symbol.

Adjacent channel interference must be small. This entails that the power spectrum of the signal should show a strong roll-off outside the desired band. Furthermore, the signal must be filtered before transmission

20. What is fading and Doppler spread?

In wireless communications, fading is deviation of the attenuation affecting a signal over certain propagation media. The fading may vary with time, geographical position or radio frequency, and is often modelled as a random process. A fading channel is a communication channel comprising fading.

The coherence time of the channel is related to a quantity known as the Doppler spread of the channel. When a user (or reflectors in its environment) is moving, the user's velocity causes a shift in the frequency of the signal transmitted along each signal path. This phenomenon is known as the Doppler shift.

21. What are the main features of QPSK?

- Very low modulation losses.
- Baseband signal processing section fully configurable.
- Internal carrier generation.
- Architectures featuring direct carrier modulation or intermediate carrier modulation with frequency up-conversion.
- Cold internal redundant configurations for increased reliability.

23. What are Rayleigh and Rician Fading?

Rayleigh fading is the name given to the form of fading that is often experienced in an environment where there is a large number of reflections present. Rayleigh fading is a statistical model for the effect of a propagation environment on a radio signal, such as that used by wireless devices.

Rician fading is a stochastic model for radio propagation anomaly caused by partial cancellation of a radio signal by itself — the signal arrives at the receiver by several different paths (hence exhibiting multipath interference), and at least one of the paths is changing (lengthening or shortening).

Rician fading occurs when one of the paths, typically a line of sight signal, is much stronger than the others. In Rician fading, the amplitude gain is characterized by a Rician distribution.

24. State the advantages of offset-QPSK.

The big advantage of OQPSK is to suppress out-of-band interference. The OQPSK will limit the phase-shift to not more than 90° at a time. This yields much lower amplitude fluctuations than non-offset QPSK.

25. List the advantages of GMSK.

GMSK modulation has improved spectral efficiency when compared to other phase shift keyed modes. It can be amplified by a non-linear amplifier and remain undistorted. In GMSK modulation none of the information is carried as amplitude variations. This means that is immune to amplitude variations and therefore more resilient to noise.

PART B

1. Explain in detail the generation & detection of MSK technique?
2. Explain in detail the generation & detection of QPSK technique?
3. Explain in detail the generation & detection of GMSK modulation?
4. Explain the performance of digital modulation in slow flat fading channel.
5. Explain error probability of coherent receivers
6. Explain Error Probability in Flat-Fading Channels
7. Explain Error Probability in Delay- and Frequency-Dispersive Fading Channels.

UNIT IV MULTIPLE ACCESS TECHNIQUES PART A

1. What are the techniques used to improve the received signal quality?

Equalization, Diversity and Channel coding

2. What is the need of equalization?

Equalization is used to compensate the inter-symbol interference created by multipath within time Dispersion channel.

3. Write the functions of diversity.

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.

4. Define spatial diversity.

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.

5. What is the function of channel coding?

Channel coding is used by the receiver to detect or correct some of the errors introduced by the channel in a particular sequence of message bits.

6. What is equalizer?

The device which equalizes the dispersive effect of a channel is referred to as an equalizer.

7. Define adaptive equalizer and write its operating modes.

To combat ISI, the equalizer coefficients should change according to the channel status so as to track the channel variations. Such an equalizer is called an adaptive equalizer since it adapts to the channel variations.

Operating modes: Training mode and tracking mode.

8. Write a short note on i) linear equalizers ii) non-linear equalizers

If the output is not used in the feedback path to adapt, then this type of equalizer is called linear equalizer. If the output is fed back to change the subsequent outputs of the equalizer, this type of equalizer is called non linear equalizers.

9. What are the factors used in adaptive algorithms?

Rate of convergence, Misadjustment, Computational complexity and numerical properties.

10. Why nonlinear equalizers are preferred? List out the nonlinear equalization methods.

The linear equalizers are very effective in equalizing channels where ISI is not severe. The severity of ISI is directly related to the spectral characteristics. In this case there are spectral nulls in the transfer function of the effective channel, the additive noise at the receiver input will be dramatically enhanced by the linear equalizer. To overcome this problem, non linear equalizers can be used.

Decision feedback equalization (DFE), Maximum likelihood symbol detection and Maximum

Likelihood sequence estimation (MLSE) are the nonlinear equalization methods used.

11. Write the advantages and disadvantages of lattice equalizer.

Advantages: It is simplest and easily available, Numerical stability, Faster convergence, Unique structure of the lattice filter allows the dynamic assignment of the most effective length of the lattice equalizer and When the channel becomes more time dispersive, the length of the equalizer can be increased by the algorithm without stopping the operation of the equalizer.

Disadvantages:

1. If the channel is not very time dispersive, only a fraction of stages are used.
2. It is more complicated than a linear transversal equalizer.

12. Define rate of convergence.

The number of iterations required for the algorithm in response to stationary inputs to converge Close enough to the optimum solution.

13. Write the basic algorithms used for adaptive equalization.

Zero forcing algorithm (ZF), least mean square algorithm (LMS) and recursive least square Algorithm (RLS).

14. Explain Diversity concept and list out its types.

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.

Types: Space diversity, Polarization diversity, Time diversity and Frequency diversity.

15. What is the need for diversity schemes?

To increase signal to noise ratio, For error free digital transmission, To degrade the bit error probability.

16. What are the two main classifications of diversity techniques?

Microscopic diversity and Macroscopic diversity

17. List out the four types of Combining Methods.

Selection combining, switched combining, Equal gain combining, Maximum ratio combining

18. What are the major classifications of speech coders?

1. waveform coders
- 2.vocoder

19. Define waveform coders.

Waveform coders are used to reproduce the time waveform of the speech signal as closely as possible. They are designed to be source dependent.

20. Define vocoders, its types and its advantages.

Vocoder is a circuit used for digitizing voice at a low data rate by using knowledge of the way in which voice sounds are produced. A vocoder is an example of lossy compression applied to human speech. Types: Linear Predictive coder, Channel vocoders, Formant vocoders, Spectrum vocoders and Voice-excited vocoders.

Advantages: It achieves very high economy in transmission bit rate, less robust.

21. Define Hamming distance.

The Hamming distance between two strings of equal length is the number of positions at which the corresponding symbols are different. In another way, it measures the minimum number of substitutions required to change one string into the other, or the minimum number of errors that could have transformed one string into the other.

22. What are the applications of nonlinear equalizers.

Used in applications where the channel distortion is too severe, also noise power is not enhanced.

23. Compare macro and micro diversity.

Macrodiversity	Microdiversity
Large-scale fading is caused by shadowing due to variations in both the terrain profile. This cause Macrodiversity	Small scale fading results in a Rayleigh distribution of signal strength over small distances. This cause Microdiversity
The distance between the transmitters is much longer than the wavelength in Macrodiversity	In microdiversity the distance is in the order of or shorter than the wavelength.
Forms of Macrodiversity:	Commom methods of microdiversity:
Single-user macrodiversity Multi-user macrodiversity	Spatial, Temporal, Frequency, Angular and Polarization microdiversities
Used to reduce small scale fading effects.	Used to reduce large scale fading effects.

24. List the different types of channel coding techniques. (Dec 2014)

- Linear Block Codes
- Cyclic codes
- BCH codes
- Reed-Solomon codes

25. Write the advantages of LMS algorithm.

It maximizes the signal to distortion at its output within the constraints of the equalizer filter length, Low computational complexity and Simple program.

PART B

1. Explain the different methods of micro diversity in detail
2. Explain several signal combining techniques in detail
3. Explain the performance of diversity reception in Fading Channels
4. Explain linear feedback equalizers in detail
5. Explain decision feedback equalizer in detail
6. Explain transmitter diversity with and without channel state information
7. Explain the working principle of Linear predictive coder
8. Explain the working principle of GSM codec with neat block diagram.
9. Explain the following codes in detail. (i) block code. (ii) convolutional code. (iii) turbo codes
10. Explain in detail about the stochastic models for speech.
11. Explain LMS and Recursive Least Square algorithm.

UNIT V**WIRELESS NETWORKING****PART A****1. What are the two types of spread spectrum multiple access? (June 13)**

Direct sequence multiple access, Frequency hopped multiple access.

2. What are the two types of frequency hopping techniques?

Fast frequency hopping and Slow frequency hopping.

3. What do you mean by Fast and slow frequency hopping?

A fast frequency hopping system is one where frequency hopping takes place faster than the data rate. Fast frequency hopping changes the carrier frequency several times during transmission of one symbol.

Slow frequency hopping transmits one or several symbols on each frequency.

4. What is OFDM? (May 2012)

Orthogonal frequency division multiplexing splits the information into N parallel streams, which are then transmitted by modulating N distinct carriers.

5. How the power control is done in the uplink?

For the uplink, power control is vital for the proper operation of CDMA. Power control is done by a closed loop. The MS first sends with a certain power, the BS then tells the MS whether the power is too high or too low and the MS adjusts its power accordingly.

6. Define cyclic prefix. (Dec 2012)

In OFDM, delay dispersion leads to a loss of orthogonality between the subcarriers and thus leads to Inter Carrier Interference (ICI). These negative effects can be eliminated by a special type of guard interval called the cyclic prefix.

7. What are the second generation standards available?

Global system mobile (GSM) in Europe, Interim Standard 136 (IS-136), Pacific Digital Cellular (PDC) in Japan, Interim Standard (IS-95) in North America.

8. What are the services offered by GSM? Write about telephone services of GSM.

i. Telephone services ii. Bearer services iii. Supplementary services.

Teleservices provide communication between two user applications according to a standard protocol. GSM mainly focuses on voice-oriented teleservices, emergency calling and facsimile. GSM also

supports videotext and teletext.

9. What are the main components of GSM? List out the subsystems available in GSM system.

Switching system(SS) and Base station system(BSS) are the main components of GSM

The subsystems available in GSM system are, i. Base station subsystem (BSS) ii. Network Switching subsystem (NSS) iii. Operation and support subsystem.

10. What are the databases available in NSS of GSM?

Home location register (HLR), Visitor location register (VLR), Authentication center (AuC).

11. Write the advantages of WLL.

Low cost, easy installation.

12. Write the functions of HLR and VLR.

HLR is a database which contains subscriber information and location information for each user who resides in the same MSC. Each subscriber has International Mobile Subscriber Identity (IMSI) and this number is used to identify each home user.

VLR is a database which temporarily stores IMSI and customer information for each roaming subscriber who is visiting the coverage area of a particular MSC.

13. Define Direct Sequence spread Spectrum.

Direct Sequence spread Spectrum(DSSS) is a modulation technique. DSSS is a transmission technology used in LAN transmissions where a data signal at the sending station is combined with a higher data rate bit sequence, or chipping code, that divides the user data according to a spreading ratio. The chipping code is a redundant bit pattern for each bit that is transmitted, which increases the signal's resistance to interference. If one or more bits in the pattern are damaged during transmission, the original data can be recovered due to the redundancy of the transmission.

14. What is piconet?

It is a collection of Bluetooth devices which are synchronized to the same hopping sequence.

15. What is handoff?

Moving from one BS to other.

16. How the power control is done in the downlink?

For the downlink, power control is vital for the proper operation of CDMA. Power control is done by a closed loop. The MS first sends with a certain power, the BS then tells the MS whether the power is too high or too low and the MS adjusts its power accordingly.

17. What is meant by vertical handoff?

Vertical handover or vertical handoff refers to a network node changing the type of connectivity it uses to access a supporting infrastructure, usually to support node mobility. For example, a suitably equipped laptop might be able to use both a high speed wireless LAN and a cellular technology for Internet access.

18. State the goals of a standard IMT-2000

IMT-2000 aims to achieve a peak data rate of 100 Mbit/s in the downlink and 50 Mbit/s in the uplink (UL), respectively, with a 20-MHz spectrum allocation for each of the downlink and uplink. Thus, the required spectral efficiency is 5 and 2.5 bit/s/Hz for the downlink and uplink, respectively.

19. What is a DECT?

Digital Enhanced Cordless Telecommunications (DECT) is a digital wireless radio technology for voice data applications (such as cordless telephones, wireless offices and even wireless telephone lines to the home). DECT uses time division multiple access (TDMA) to transmit radio signals to phones and is best-suited to smaller areas with a large number of users. It has been designed and specified to work with many other types of network, such as the PSTN, ISDN, GSM and others

20. Why QPSK is preferred for wireless communication?

In QPSK two successive bits in the data sequence are grouped together. This reduces bit rate or signalling Rate and hence reduces the bandwidth of the channel. 1 symbol= 2 bits

21. List the advantages of third generation (3G) networks.

3G networks offer users advantages such as:

- New radio spectrum to relieve overcrowding in existing systems.
- More bandwidth, security, and reliability.
- Interoperability between service providers.
- Fixed and variable data rates.

- Asymmetric data rates.
- Backward compatibility of devices with existing networks.
- Always-online devices. 3G will use IP connectivity, IP is packet based (not circuit based).
- Rich multimedia services.

22. What are the effects of multipath propagation in CDMA?

The basic nature of a CDMA system is to spread the signal over a large bandwidth thus it can be anticipated that the transfer function of the channel exhibits variations over this bandwidth.

The effect of frequency selectivity on a CDMA system can be understood by the impulse response of the concatenation spreader-channel-despreader .

23. What is Bluetooth?

Bluetooth is an open specification for short range wireless voice and data communications that was Originally developed for cable replacement in personal area networking to operate all over the world.

24. List the important features of 3G networks.

Some features of 3G services:

- Always-on connectivity. 3G networks use IP connectivity, which is packet based.
- Multi-media services with streaming audio and video.
- Email with full-fledged attachments such as PowerPoint files.
- Instant messaging with video/audio clips.
- Fast downloads of large files such as faxes and PowerPoint files.
- Access to corporate applications.

PART-B

1. Explain in detail the CDMA multiple access technique.
2. Explain the principles of Frequency Hopping spread spectrum technique and direct sequence spread spectrum technique.
3. Explain the principles of Code Division Multiple Access and compared with TDMA
4. Explain about Cellular Code-Division-Multiple-Access Systems and power control Multiple Access
5. Explain the operations of orthogonal frequency division multiplexing and define and list the benefits of cyclic prefix cyclic prefix.
6. Detail notes about GSM – system overview, physical and logical channels
7. Explain about IS-95 used for wireless communication/ Explain forward & reverse channel parameters of IS-95 CDMA
8. Discuss about 3G standards – WCDMA/UMTS for wireless network.