Wireless Networking - Questions Bank for Final Exam 25-26

Lecture 1-Radio Propagation

1. Why we need to deploy Wireless Networks?
2. What are the main problems with Wireless Networks
3. Define Electromagnetic wave with typical drawing showing electrical and magnetic fields.
4. In waveform define: Cycle, Amplitude, Velocity of Propagation, Period, and Wavelength.
5. Radio Waves have the _____ wavelengths and the _____ frequencies.
6. _____ waves are used in Wireless Communications
7. _____ waves are used for finding people in the dark and in TV remote control devices.
8. The _____ waves have less frequencies than visible lights, while the _____ waves have more frequencies than visible lights.
9. _____ are used to look at solid structures, such as bones and bridges.
10. _____ are used in the treatment of cancers.
11. Define
    a) Reflection,
    b) Diffraction,
    c) Scattering,
    d) Attenuation, and
    e) Link budget.
12. List only the Signal propagation ranges with drawing.
13. Please convert the power value of **100 mW** to dBm.
14. Please convert the power value of **30 dBm** to mW.
15. Using a Point-to-Point radio system for a distance of 5 km and frequency of 5.8 GHz. The same device is used in both sides. The transmitting power is +23dBm, and the built in antenna gain is 24dBi. The Wireless radio has an integrated antenna, so there is no loss for cabling. On the receiving side the receive sensitivity is -72dBm with the same gain antenna of the transmitting side.
    Please calculate the link budget of this link with drawing illustration.
16. A wireless link of 8 km distance, with one access point and one client radio. The access point is connected to an antenna with 10 dBi gain, with a transmitting power of 20 dBm. The client is connected to an antenna with 14 dBi gain, with a transmitting power of 12 dBm and a receive sensitivity of -82 dBm. The cables in both systems are short, with a loss of 2dB at each side at the 5 GHz frequency of operation.
    Please calculate the link budget of this link from access point to radio client with drawing illustration.
17. Define Fresnel Zone with typical drawing.

Lecture 2- Antennas.

1. Define
   a) Antenna,
   b) Isotropic Antenna ,
   c) Antenna Gain,
   d) Antenna bandwidth,
   e) Antenna Beam Width,
   f) Antenna Polarization,
   g) Radiation Pattern and
   h) Reciprocity.
2. The polarization of transmitting and receiving antennas _____ for optimum communications.
3. Some basic tools for antenna alignment are _____ , _____ and _____.
4. You can interactively optimize the antenna alignment with the _____
5. A _____ antenna most commonly refers to a half-wavelength
6. The _____ antenna is a simple antenna that radiates its energy out toward the horizon
7. Draw typical radiation pattern for Dipole antenna (Azimuth and Elevation patterns only)
8. Draw typical radiation pattern for Patch antenna (Azimuth and Elevation patterns only)
9. Draw typical radiation pattern for Sector antenna (Azimuth and Elevation patterns only)
10. Draw typical radiation pattern for Dish antenna (Azimuth and Elevation patterns only)
11. A _____ antenna, is just a single rectangular (or circular) conductive plate that is spaced above a ground plane
12. Small Patch Antennas are used for applications, while Large Patch Antennas are used of _____ point to point links
13. Sector Antennas are used mainly for _____ towers and _____ towers.
14. In dish Antenna, why The parabolic shape is important?
15. _____ are used in long distance Point to Point outdoor connections

Lecture 3 - Modulation and MA Techniques

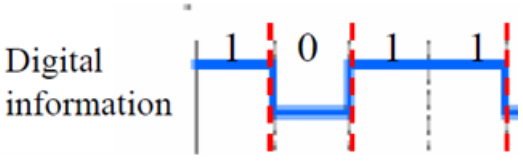
1. Draw a block diagram of Digital Communication System
2. The Communication Systems goals are to maximize or minimize below parameters

   - To _____ transmission rate.
   - To _____system utilization.
   - To _____bit error rate.
   - To _____ required systems bandwidth.
   - To _____system complexity.
   - To _____ required power.

3. Define:

   a) Source Encoder
   b) Channel Encoder
   c) Modulator
   d) Multiple Access Techniques
   e) The communication channel
   f) The demodulator
   g) Channel Decoder
   h) Source Decoder
   i) Channel Capacity
   j) Bandwidth
   k) Noise
   l) Bit Error Rate
   m) Fourier transform

4. List the analogue modulation schemes.
5. List Motivation for Modulation use
6. Define Digital modulation and List important schemes.
7. Define AM with its disadvantage.
8. Define FM showing the advantage of FM over AM.
9. Explain the Advantages of Digital Modulation over Analogue Modulation?
10. For the below data, please draw the resulting signal from ASK, FSK, and PSK.



11. In QPSK to achieve high data rates with a narrowband channel is to increase the number of _____.
12. QPSK systems has twice the bandwidth efficiency of that of BPSK. (T/F)
13. Quadrature amplitude modulation is a combination of _____ and _____
14. List the variations of QAM modulation.
15. Define
    a) Constellation diagram and
    b) Bandwidth Efficiency
16. What is the typical constellation diagram for the following digital modulation techniques: ASK, BPSK, QPSK, 4-QAm and 16-QAM.
17. The Goal of Multiple Access Techniques is _____.
18. List The types of Multiple Access Techniques.
19. Define TDMA, FDMA, SDMA, and CDMA.
20. In the TDMA throughput is _____ even for many users.
21. The Disadvantage of TDMA is _____
22. Define FDMA and list its advantages and disadvantages.
23. In time Multiplex precise _____ is required while in Frequency Multiplex no _____ is required.
24. In Time and Frequency Multiplex, there is better protection against _____ and _____
25. In Time and Frequency Multiplex has higher data rates compared to _____
26. In Time and Frequency Multiplex precise _____ is required
27. Define SDMA
28. In SDMA the no interference is ensured by using different _____ in each cell
29. In CDMA each channel has a unique code. (T/F)
30. In CDMA all channels use _____
31. What are the advantages and disadvantages of CDMA?

Lecture 4 - Satellite Systems

1. Define Communications Satellite.
2. A satellite travels in a special path, called its _____.
3. _____ is the frequency at which Ground Station is communicating with Satellite.
4. The satellite Transponder converts the signal and sends it down to the second earth station. Using the _____ frequency.
5. What are the advantages of Satellite vs. Ground Communication?
6. What are the disadvantages of Satellite vs. Ground Communication?
7. Define Satellite Footprint
8. List the three major Satellite Frequency Bands.
9. As wavelength increases _____ antennas are necessary to gather the signal from Satllites.
10. C-band satellite transmissions occupy the _____ to _____ GHz frequency range.
11. The larger wavelengths of the C-band mean that a larger satellite _____ is required.
12. Ku-band satellite transmissions occupy the _____ to _____ GHz frequency range.
13. Ka-band satellite transmissions occupy the _____ to _____ GHz frequency range.
14. List Three Types of Satellites based on their Orbits.
15. Define LEO Satellites.
16. List the advantages of LEO Satellites.
17. List the disadvantages of LEO Satellites.
18. The majority of satellites, have been in _____ orbit.
19. _____ satellites and _____ satellites use LEO as they are able to see the surface of the Earth more clearly.
20. Define MEO Satellites.
21. List the advantages of MEO Satellites compared with LEO.
22. List the disadvantages of MEO Satellites compared with LEO.
23. The most common use for MEO satellites in this region is for _____, and _____.
24. Define GEO Satellites.
25. GEO Satellites orbit around the _____
26. The earth station antenna can be pointed _____ at the position in the sky where GEO Satellites stays.
27. _____ and _____ are often given geostationary orbits.
28. List the advantages of GEO Satellites.
29. List the disadvantages of GEO Satellites.
30. List Five of Satellite Applications.
31. Define Astronomy satellites.
32. Explain how does GPS work?
33. Define VSAT

34. List Five VSAT Services
35. VSAT technology normally connects a large number of geographically dispersed sites. (T/F)
36. VSAT is used as a _____ Internet connection in rural areas and a _____ connection in cities.
37. The VSAT Two-Way Network Architecture has two topologies are _____ topology and _____ topology
38. While using VSAT for _____ we should consider time delay for control signals.
39. Draw Typical VSAT Network Diagram
40. Draw VSAT Network Architectures – Two-Way for both:
    - Star Topology
    - Mesh Topology
41. In VSAT _____ topology all VSATs Communicate via a Single Hub
42. In VSAT _____ topology VSATs communicate directly with each other.
43. VSAT _____ topology is used extensively in Telephony Networks since delay is _____ on VSAT to VSAT Calls
44. In VSAT Two-Way Mesh Topology _____, and _____ are required at the VSAT station more than Two-Way Star Topology.

Lecture 5- GSM – Cellular Networks

1. Define: Cellular network, and Cell.
2. _____ is the abbreviation for Global System for Mobile Communications
3. 1G Networks: are based an _____ technology where the phones had poor _____ and _____ while _____ was heavy and has less capacity.
4. 2G Networks: are based on a _____ technology with GSM standard
5. List the 2G fundamental services.
6. In 2G, the data communication was based on _____ and _____
7. List the new Smartphone technology services came with 3G.
8. In 3G, the data communication was based on _____ and _____
9. 4G was based on _____ that integrates all communications _____, _____ and _____) using the _____.
10. List the four GSM Frequencies.
11. In GSM Each channel has _____ KHz and _____ ms.
12. A single GSM Carrier is divided into _____ timeslots.
13. In GSM the logical channels types are _____ and _____ .
14. Draw the GSM Architecture diagram.
15. Define IMEI, and SIM.
16. List the functions of Base Station Controller (BSC).
17. List the functions of Base Transceiver System (BTS)
18. Define MSC, VLR, and GMSC
19. List the four GSM Handover Categories.
20. Draw simple diagrams for the four GSM Handover Categories
21. In Intra-BTS handover the mobile will be locked to the same _____ but the _____ allocated to that mobile will change.
22. Inter-BTS Intra BSC handover occurs between two _____. Therefore it has to be controlled by _____
23. Inter-BSC handover occurs between two _____. Therefore it has to be controlled by ___ _____
24. Define Roaming.
25. What is Frequency Reuse key design?
26. Assume a system of total cells of 48 cells with a cell radius of 1.2 km, a total frequency bandwidth that supports 70 traffic channels, and a reuse factor of N=7.

    – What is the geographic area covered?
    – How many channels are per cell?
    – What is the total number of concurrent calls that can be handled by all cells?

27. Design a GSM system with 2800 total concurrent calls, if you know that it has a total frequency bandwidth that supports 196 traffic channels, and a reuse factor of N=7 with the geographic area of 278 km^2
    - How many channels are per cell?
    - What is the total number of cells?
    - What is the cell radius?

Lecture 6- Wireless LAN

1. Wi-Fi works on _____ and _____ layers.
2. List the four WiFi standards
3. List the WLAN components
4. The AP function is _____
5. The wireless NIC Types are:
6. For Desktop: _____ and _____
7. For Laptop _____ and _____
8. For Mobile: _____
9. List the WLAN Installation Types
10. In _____ mode, wireless clients will only communicate with an access point.
11. Draw the Network Diagram of Typical WiFi Home Network.
12. IEEE 802.11b works at frequency of _____ with theoretical speed of _____.
13. IEEE 802.11b suffers from _____ from mobile phones and Bluetooth devices.
14. IEEE 802.11a works at frequency of _____ with theoretical speed of _____.
15. IEEE 802.11a is compatible with IEEE 802.11b. (T/F)
16. IEEE 802.11g works at frequency of _____ with theoretical speed of_____ with _____ range.
17. IEEE 802.11g is compatible with IEEE 802.11b (T/F)
18. IEEE 802.11n works at frequency of _____ and _____with theoretical speed of_____
19. IEEE 802.11n is compatible with IEEE 802.11b (T/F)
20. List with comparison the 802.11n standard modes.
21. List the seven applications of WiFi.
22. List the three security techniques of WiFi
23. WPA uses _____ Encryption while WPA2 uses _____ Encryption
24. The _____ security techniques in WiFi is no longer used because it can be easily hacked.
25. In WiFi _____ offers protection against interference in the 2.4 GHz spectrum.
26. The _____ standard was one of the first commercial standards using MIMO technology.
27. Define MIMO
28. If a SISO system were able to achieve a data rate of 100 Mb/s, an 8x8 MIMO system can achieve a maximum data rate of _____.
29. Explain in the details of 802.11 Passive/Active Scanning
30. Draw the diagrams of 802.11 Passive/Active Scanning
31. In CSMA/CA, once the channel is determined to be idle, client send _____packet. The AP device then sends a _____ reply to the request.
32. In 2.4 GHz band, the non-overlapping channels are: _____, _____, and _____.
33. In 5 GHz band, using 20 MHz, there are _____ non-overlapping channels
34. The 802.11n standard introduced _____, which enabled 40 MHz widths.

35. Define FHSS

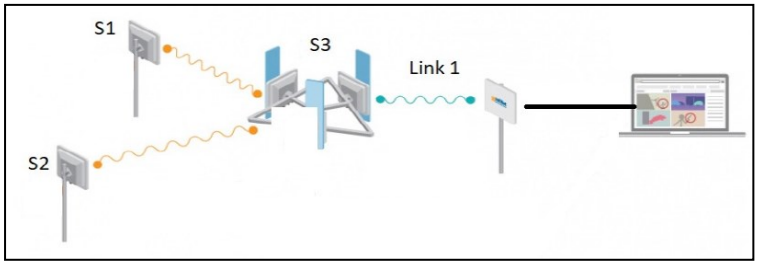
36. In DSSS transmissions, the modulated signal is multiplied by a _____ spreading code

37. OFDM was adopted as part of the _____ specification, and _____ specification.

38. In OFDM the transmitter creates an array of _____ which must be _____ to each other.

1. In city wide Video Network, assume:

- Network diagram is below



- The table for the number of cameras in each site is:

Site	# Cameras
S1	1
S2	1
S3	1

- Camera bandwidth requirement is 4 Mbps
- TX power is 20 dBm,
- Antenna Gain is14 dBi for both sides:
- Link 1 distance is 7 Km
- Frequency is 12 GHz
- The Receive Sensitivity table is

Parameters	SNR (Rx) [dB]	RESICEVER Sensitivity S_R [dB]	Usefull Channel Capacity Cmodulation [Mbps]
QPSK CTC 1/2	3.5	-98.6561	4.0816
QPSK CTC 3/4	6.5	-97.4170	6.1224
16-QAM CTC1/2	9.0	-96.1664	8.1633
16-QAM CTC 3/4	12.5	-94.4273	12.245
64-QAM CTC 2/3	16.5	-91.6767	16.327
64-QAM CTC 3/4	18.5	-90.1883	18.367

Calculate Link budget for Link1 with drawing