15EC403-Wireless Communication

QUESTION BANK

UNIT I

INTRODUCTION TO WIRELESS COMMUNICATION

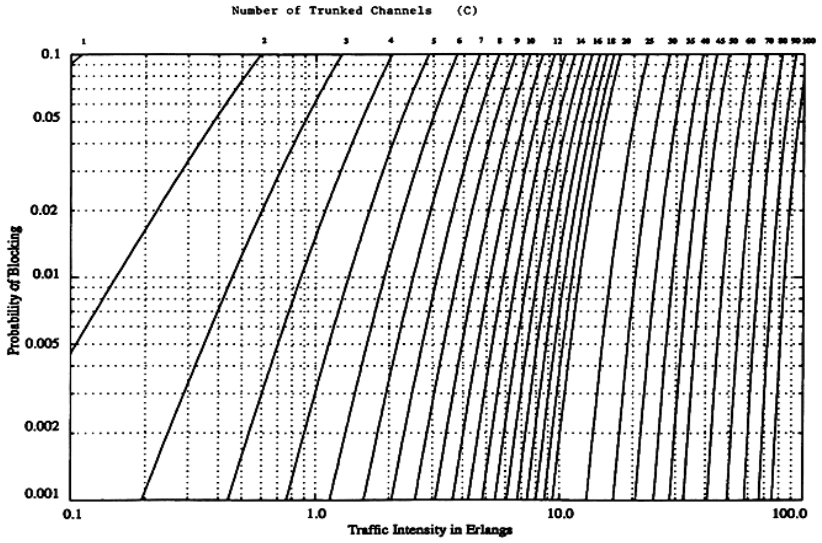
PART – B

1. What are the classifications of mobile radio transmission systems? (hint – Simplex, half duplex, full duplex)
2. "Paging systems are an example of simplex communications". Justify the aforementioned statement with the help of a block diagram.
3. With the help of a block diagram elaborate on cordless telephone systems.
4. With the aid of a block diagram brief about cellular telephone systems.
5. What do you mean by forward and reverse channel with respect to cellular communications?
6. What do you mean by Frequency reuse?
7. "Hexagonal shapes are chosen as the optimum cell geometry". Ornate the importance of the aforementioned statement.
8. Define Frequency reuse distance.
9. What is a cell and a cluster?
10. For a cluster size of 7, if there are 490 channels used for the entire cluster. Calculate how many frequency bands can be handled by a cell. Also calculate the frequency reuse distance for a cell radius of 780 metres.
11. What a mobile engineer should do to find the nearest co-channel neighbors of a particular cell?
12. What are the channel assignment strategies?
13. Define handoff and dwell time.
14. Elaborate on the classification of Handoff.
15. Mention the types of handoff based on the cell, BSC and MSC switching.
16. What do you mean by Mobile assisted handoff?
17. Brief about Network assisted handoff?
18. "I use *different antenna heights* and *Tx power levels* to provide large and small cell coverage". Identify me and elaborate on the significance of my existence.
19. Define co channel reuse ratio and What is the co-channel reuse ratio for a cluster size 7.
20. What is co channel interference?
21. Define adjacent channel interference
22. Define Grade of service and traffic intensity.
23. Briefly elaborate on blocked call clear systems and write the expression for the same.
24. What is blocked call delay system? Write the expression for the same.
25. If a group of 100 users made 30 calls in one hour, and each call had an average call duration (holding time) of 5 minutes, then what is the traffic intensity (in erlangs)?
26. What is cell sectoring?

27. Enumerate the importance of microcell zone concept?
28. "As New Area is ¼ of the older area (now one bigger cell include approximately 4 smaller cell), therefore the capacity of system is increased by 4 times". Justify the aforementioned statement if the Total BW available is 25MHz and each user Requires 25kHz.
29. What are the techniques used to expand the capacity of cellular system?

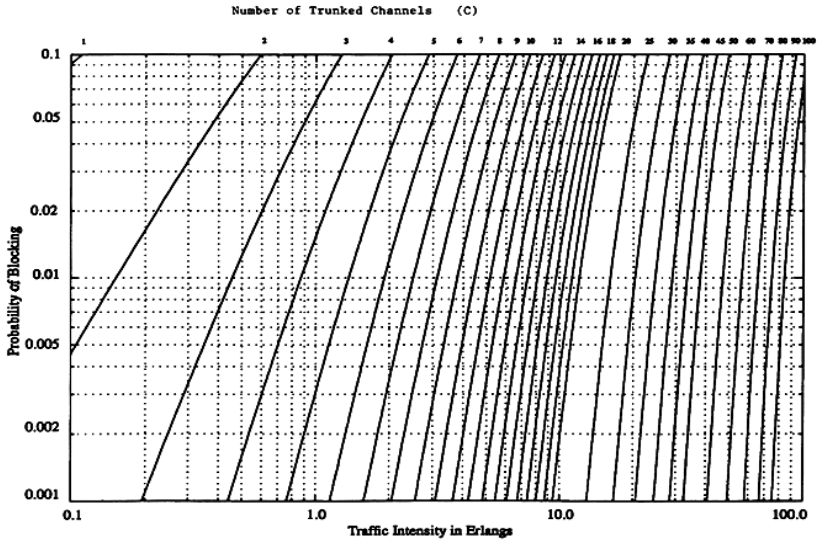
PART – C

1. With the help of a timing diagram explain how a call to a mobile user initiated by a landline subscriber is established.
2. With the aid of a timing diagram explain how a call initiated by a mobile is established.
3. Define Handoff and what are the different types of handoff? Explain each with the help of a neat diagram.
4. a. Describe the Channel assignment strategies.
   b. Brief about guard channel concept.
5. Explain in detail the strategies of Handoff.
6. With the help of a diagram and equation describe Co-Channel Interference & System Capacity.
7. How many users can be supported for 0.5% blocking probability for the following number of trunked channels in a BCC system? (a) 5, (b) 10,(c)=20. Assumed that each user generates 0.1 Erlangs of traffic. (The graph below can be used)

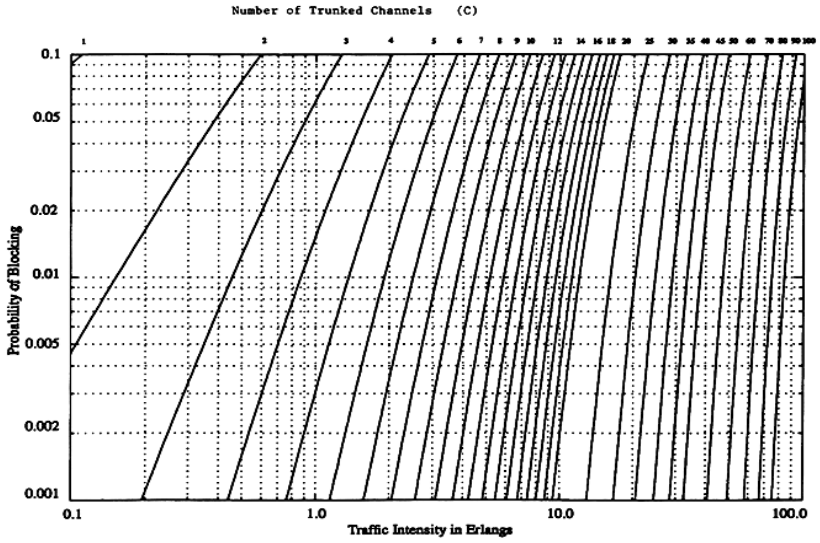


8. Discuss the techniques involved in improving Coverage & Capacity in Cellular system.
9. a. "As New Area is 1/N of the older area (now one bigger cell include approximately 4 smaller cell), therefore the capacity of system is increased by N times". Justify the aforementioned statement if the Total BW available is 25MHz and each user requires 25kHz.
   b. For the path loss exponent of 4 and cell splitting of 0.5, calculate the ratio of P_{t1} Transmit Power at old cell boundaries) to P_{t2} (Transmit Power at new cell boundaries).
10. Explain in detail 60 degrees and 120 degrees sectoring.

11. An urban area has a population of 2 million residents. Three competing trunked mobile networks (systems A, B, and C) provide cellular service in this area. System A has 394 cells with 19 channels each, system B has 98 cells with 57 channels each, and system C has 49 cells, each with 100 channels. Find the number of users that can be supported at 2% blocking if each user averages 2 calls per hour at an average call duration of 3 minutes. Assuming that all three trunked systems are operated at maximum capacity, compute the percentage market penetration of each cellular provider. (The graph below can be used)



12. If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (a) 4-cell reuse, (b) 7-cell reuse (c) 12-cell reuse. If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell for each of the three systems.
13. If a signal to interference ratio of 15 dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity if the path loss exponent is (a) n = 4 , (b) n = 3? Assume that there are 6 co-channels cells in the first tier, and all of them are at the same distance from the mobile. Use suitable approximations.
14. A certain city has an area of 1,300 square miles and is covered by a cellular system using a 7-cell reuse pattern. Each cell has a radius of 4 miles and the city is allocated 40 MHz of spectrum with a full duplex channel bandwidth of 60 kHz. Assume a GOS of 2% for an Erlang B system is specified. If the offered traffic per user is 0.03 Erlangs, compute (a) the number of cells in the service area, (b) the number of channels per cell, (c) traffic intensity of each cell, (d) the maximum carried traffic; (e) the total number of users that can be served for 2% GOS, (f') the number of mobiles per channel, and (g) the theoretical maximum number of users that could be served at one time by the system. (The graph below can be used)



UNIT II

MOBILE RADIO WAVE PROPAGATION (LARGE SCALE FADING)

PART – B

1. What are the propagation mechanisms of EM waves?
2. What are the significance of propagation model?
3. When does large scale propagation occur?
4. Define coherence time & EIRP
5. What is Brewster angle?
6. Mention some outdoor propagation models?
7. What are merits and demerits of Okumara's model?
8. List the advantages and disadvantages of Hata model?
9. Find the far field distance for an antenna with maximum dimension of 2m and operating frequency of 1 GHz
10. State the propagation effects in mobile radio.
11. Write the effects of fading.
12. Write notes on Cell coverage area.
13. What is Shadow fading?

PART – C

1. Explain two-ray ground reflection model in detail.
2. Explain free space propagation model with suitable expressions.
3. Explain the advantages and disadvantages of the two ray ground reflection model in the analysis of path loss ii) In the following cases tell whether the two ray model could be applied and justify why or why not Case (i) : h_1=35m, h_r=3m, d=250 m case (ii) h_1=30m, h_r=1.5m, d=450 m iii)Prove that in the two tray ground reflection model d =d''- d'=$2h_th_r/d$

4. If a transmitter produces 50 watts of power, express the transmit power in units of (a) dBm, and (b) dBW. If 50 watts is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBm at a free space distance of 100 m from the antenna, What is P_r (10 km)? Assume unity gain for the receiver antenna.

5. A mobile is located 5 km away from a base station and uses a vertical λ/4 monopole antenna with a gain of 2.55 dB to receive cellular3radio signals. The E-field at 1 km from the transmitter is measured to be10^{-3} V/m. The carrier frequency used for this system is 900 MHz.
   (a) Find the length and the gain of the receiving antenna. (b) Find the received power at the mobile using the 2-ray ground reflection model assuming the height of the transmitting antenna is 50 m and the receiving antenna is 1.5 m above ground.
6. Explain the various types of outdoor propagation model
7. Explain in detail the three significant wave propagation mechanisms that affect the propagation of EM waves
8. i) Describe the empirical path loss model and simplified path loss model with suitable expressions.
9. Discuss the Okumara and Hata outdoor propagation model in detail.
10. Explain the free space path loss model, and describe the following a).log-distance path loss model, b).log-normal shading path loss model c). determination of percentage of coverage

Unit-III

Mobile Radio Wave Propagation (Small Scale Fading & Multipath)

PART-B

1. What is meant by coherence bandwidth and Doppler shift?
2. What are the three most important effects due to multipath in mobile radio channel?
3. What are the factors influencing small scale fading?
4. What do you mean by small scale fading?
5. What are the different fading effects due to Doppler spread?
6. What is meant by Doppler shift?
7. Distinguish between flat fading and frequency selective fading.
8. Distinguish between slow fading and fast fading.
9. What are the types of small scale fading?
10. What is meant by flat fading channel?
11. What is meant by frequency selective fading?
12. Write the probability density function (pdf) of Rayleigh distribution?
13. Write the pdf of Ricean distribution

PART-C

1. Explain the impulse response model of multipath channel with necessary equation and diagrams?
2. Explain the different parameters of mobile multipath channel.
3. Describe the measurement techniques of small scale multipath channels.
4. Explain the fading effects due to multipath time delays spread and fading effects due to doppler spread
5. Describe the types of small scale fading in detail.

Unit-IV

Capacity, Diversity and Equalization in Wireless systems

PART-B

1. Compare time diversity and frequency diversity.
2. What is the necessity of diversity technique in the communication receiver?
3. What are the advantages of maximal ratio combining over selection combining
4. Compare selection combining and feedback combining techniques.
5. What are the merits and demerits of feedback combining?
6. What is the need for interleaving and why is it used in speech coders?
7. Draw the schematic diagram of a block interleaver and explain its working principle.
8. Derive an expression for Shannon capacity of the channel in an AWGN channel.
9. What is the need for diversity in wireless communication system?
10. Write short notes on interleaving

PART –C

1. Explain the working principle of RAKE receiver in CDMA systems with a neat block diagram
2. Explain the following combining techniques with neat diagram:

i) Selection combining
ii) Feedback combining
iii) Maximal ratio combining

3. Derive an expression for capacity of the flat fading channel and its outage when the CSI is known at both transmitter and receiver.
4. i) Consider a AWGN channel , derive an expression for the capacity of the channel
   ii) Explain the time diversity and frequency diversity
5. Explain the following diversity techniques:
   i) Time diversity
   ii) Frequency diversity
   iii) Interleaving
6. Explain the working principle of block interleaver and any two diversity combining techniques with neat diagram.

UNIT V

WIRELESS SYSTEM AND STANDARDS

PART – B

1. What are the three subsystems of GSM architecture?
2. Brief about home location register and visitor location register.
3. Name the interfaces used in GSM.
4. With respect to GSM how many multi-frames make a super-frame and how many timeslots make a multi-frame?
5. Draw the block diagram of "GSM operations from speech input to speech output".
6. Enumerate the advantages of spread spectrum technique.
7. Draw the block diagram of Direct sequence spread spectrum transmitter and receiver.
8. Sketch the block diagram of Frequency hopping spread spectrum transmitter.
9. Draw the block diagram of Frequency hopping spread spectrum receiver.
10. List any two properties of PN sequence.
11. What do you mean by multicarrier modulation?
12. Ornate the benefits of cyclic prefix in OFDM.
13. Differentiate between FDM and OFDM.
14. What is PAPR?
15. Elaborate on the disadvantages of OFDM.

PART – C

1. Explain in detail about CDMA transmitter with a neat block diagram.
2. Elucidate in detail about CDMA receiver with a neat block diagram
3. Explain with necessary diagram, the operation of OFDM transceiver.
4. With the help of block diagram explain in detail the Direct sequence spread spectrum transmitter and receiver.
5. Explain in detail and with the aid of block diagram, the Frequency Hopping spread spectrum transmitter and receiver.
6. Elaborate in detail the GSM frame structure and its interfaces.
7. With the help of Architecture block diagram, explain in detail the various subsystems of the GSM services.