UNIT I

CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS

PART-A
1. Give any four examples of wireless communication systems.
2. What is a base station?
3. What is EDGE? Give the channel bandwidth for the same.
4. List any four advantages of third generation (3G) mobile networks.
5. What are the advantages of micro cell zone concept?
6. What are the reasons for choosing Hexagonal cells?
7. Write four objectives of channel assignment strategies.
8. What is borrowing strategy in channel assignment?
9. Define MAHO.
10. What is the method to use the limited spectrum to unlimited subscribers?
11. Write the formula for co-channel reuse ratio.
12. What is cell splitting?
13. List the methods to improve coverage and capacity in cellular systems.
14. What are the most popular standards of second generation?

PART-B
1. Explain the cellular system architecture in detail. (16)
2. (a) Explain in detail the various cellular components. (8)
   (b) Explain the fundamentals of Digital Cellular systems. (8)
3. (a) Discuss different techniques used for improving coverage and capacity in cellular systems. (8)

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(b) Discuss the different interferences applicable in the transmission of cellular signals. (8)

4. Explain in detail the various applications of GPRS. (16)

5. Explain in detail the architecture of GPRS. (16)

6. Explain the concept of frequency reuse in detail. (16)

7. Explain the operations of cellular systems. (16)

8. Explain the various types of Handoff processes. (16)

9. (a) A hexagonal cell with a radius of 1.387km. a total of 60 channels are used within the entire system. If the load per user is 0.029 erlangs, and $\lambda=1$ call/hour compute the following for an erlangs C system that has a 5% probability of a delayed call. (8)
   
   i. How many users per square kilometers will this system support?
   
   ii. What is the probability that a delayed call will have to wait for more than 10 seconds?
   
   iii. What is the probability that the call will be delayed for more than 10 seconds?

(b) How many users can be supported for 0.5% blocking probability for the following number of trunked in a blocked calls cleared system? (i) 1 (ii) 5 (iii) 10 (iv) 20 (v) 100. Assume each user generates 0.1 Erlangs of traffic. (8)

10. (a) Explain the process of operation of paging systems. (8)

(b) Describe the steps involved in making a cellular telephone call. (8)

UNIT- II

MOBILE RADIO PROPAGATION

PART-A

1. What are the three basic propagation mechanisms in mobile communication system?

2. Calculate the Fraunhofer distance of an antenna at 60MHz for a maximum dimension of 1m.

3. What is Point-to-point mode prediction and Area mode prediction in Longely-Rice propagation model?

4. Mention any for Indoor propagation models.

5. Calculate the Brewster angle for a wave impinging on ground having a permittivity of $\varepsilon_r = 4$.

6. List out the three small-scale fading effects of multipath in the radio channel.

7. What are the two advantages of the spread spectrum channel sounding system?

8. What is Doppler shift?

9. List out the types of small-scale multipath measurements techniques.

10. Consider a transmitter, which radiates a sinusoidal carrier frequency of 1850 MHz. For a vehicle moving 60mph, compute the received carrier frequency if the mobile is moving directly away from the transmitter.
11. What is level crossing rate?
12. Define Doppler spread and Write the relationship between Doppler spread and Coherence time.
13. What is meant by Coherence bandwidth?
15. What are the Time Dispersion Parameters of Multipath channels?

**PART-B**

1. (i) Derive the equation of Power received at particular distance ‘d’ from the transmitter for a Free-space Propagation model. (12)

(ii) A mobile is located 5 km away from a base station and uses a vertical $\lambda/4$ monopole antenna with a gain of 2.55 dB to receive cellular radio signals. The E-field at 1 km from the transmitter is measured to be $V/rn$. The carrier frequency used for this system is 900 MHz. Find the length and the gain of the receiving antenna. (4)

2. Derive the Equation of the Path loss for the two-ray model with Antenna gains. (16)

3. (i) In a mobile network, the minimum required signal-to-noise-ratio is 10 dB. The background noise at the frequency of operation is –115 dBm. If the transmitter power is 10 W, transmitter antenna gain is 3 dBi, the receiver antenna gain is 2 dBi, the frequency of operation is 800 MHz, and the base station and mobile heights are 100 m and 1.4 m respectively, determine the maximum in building penetration loss that is acceptable for a base station with coverage of 5 km if the following path loss models are used. Calculate
(a) Free space path loss model. (b) Two ray path loss model (12)

(ii) What is the received power(in dBm) in free space of a signal whose transmit power is 1 Watt and carrier frequency is 2.4 GHz if the receiver is at a distance of 1.6 km. (Assume antenna gains to be unity) (4)

4. Discuss about the following Outdoor propagation models. (i) Longely-Rice Model (ii) Okumura Model (iii)Hata Model (iv)Walfisch and Bertoni Model. (16)

5. Derive the Impulse response model of a Multipath channel (16)

6. Assume a mobile traveling at a velocity of 10m/s receives two multipath components at a carrier frequency of 1000MHz. The first component is assumed to arrive at $t = 0$ with an initial phase of $0^\circ$ and a power of $-70$dBm. The second component is 3dB weaker than the first one and arrives at $t = 1\mu$ s, also with the initial phase of $0^\circ$. If the mobile moves directly to the direction of arrival of the first component and directly away from the direction of arrival of the second component. compute the following: (16)
   a. The narrow band and wide band received power over the interval 0-0.5s
   b. The average narrow band received power.

7. (a) What is small scale fading? What are the factors influencing small scale fading? (8)

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(b) Explain about the swept frequency measurements.  

8. Explain detail about type of small scale fading?  

9. Derive expression for the Clarke’s model for flat fading?  

10. (a) Explain detail about Two-ray Rayleigh Fading model?  

(b) By varying $\tau$, is it possible to create a wide range of frequency selective fading effects. Find the average fade duration. For threshold levels $\rho=0.01$, $\rho=0.1$ and $\rho=1$ when the Doppler frequency is 200Hz.  

(c) Determine the proper spatial sampling interval required to make small scale propagation measurements which assume that consecutive samples are highly correlated in time. How many samples will be required over 10m travel distance if $f_c=1900$MHz and $v=50$ m/s. How long would it take to make these measurements, assuming they could be made in real time from a moving vehicle? What is meant by Doppler spread BD for the channel?  

UNIT III  
MODULATION TECHNIQUES AND EQUALIZATION  
PART-A  
1. Name the four space diversity reception techniques.  
2. Mention two advantages and disadvantages of LMS gradient DFE.  
3. What is meant by decision feedback equalization?  
4. What is CPFSK? What is the main feature of the CPFSK?  
5. Write any three advantages of Constant envelope modulation.  
6. Mention the bit error probability of GMSK.  
7. Write the four important properties of MSK.  
8. Define absolute bandwidth.  
9. Name any three parameters useful to calculate BER.  
10. What is the use of CMA?  

PART-B  
1. (a) Write shorts on RAKE receiver, with block diagram.  

(b) Write notes on frequency diversity and time diversity.  

2. What is Non-linear equalization? Explain the two methods used in 2G and 3G systems.  

3. (a) Write notes on Microscopic diversity and macroscopic diversity.  

(b) Consider the design of the US digital cellular equalizer. If $f = 900$MHz and the mobile velocity $V = 80$ km/hr, determine the following: a) The maximum Doppler shift b) The coherence time of the channel c) The maximum number of symbols that could be transmitted without updating the equalizer, assuming that the symbol rate is 24.3 ksymbols/sec.  

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4. Write notes on M-ary Quadrature Amplitude Modulation. Draw the consultation diagram of an M-ary QAM for M=16 signal set. (16)
5. Explain MFSK and describe its frequency spectrum. (16)
6. (a) Compare BPSK and QPSK modulation schemes. (8)
   (b) Write notes on: i) small scale fading and large scale fading
       ii) input output channel models
       iii) statistical channel model. (8)
7. Write notes on the PSK and various types of PSK. (16)
8. (a) With neat block diagram, explain Minimum Shift Keying. (10)
   (b) What is the power spectral density of MSK signal? Compare its psd with QPSK and OQPSK signal. (6)
9. (a) Explain any four factors used to determine the performance of an adaptive equalization algorithm. (6)
   (b) Explain LMS and Recursive Least Square algorithm. (10)
10. Bring out the salient features of the GMSK modulation scheme. Explain the GMSK transmitter and receiver implementation with suitable diagram. (16)

UNIT IV
CODING AND MULTIPLE ACCESS TECHNIQUES
PART-A
1. What is meant by vocoders?
2. Which one is the most popular vocoding system? Why?
3. What are the approaches available in LPC excitation methods?
4. What is self-jamming in CDMA?
5. Why is CDPD advantageous?
6. What are the advantages of RELP codec?
7. What are the characteristics of the speech codec for Mobile communication?
8. What is frequency Hopped Multiple Access (FHMA)?
9. Give the expression for finding channel capacity for a radio system.
10. If a US AMPS cellular operator is allocated 12.5 MHZ for each simplex band & if Bt is 12.5 MHz, Bguard is 10 KHz & Bc is 30 KHz, Find the number of channels available in an FDMA system.
PART-B

1. Draw the block diagram of a LPC coding system & explain the different types of LPC used for wireless systems. (16)

2. Compare Between FDMA, TDMA, CDMA, SDMA. (16)

3. (a) What do you mean by duplexing? Explain the types of duplexing. (8)
   (b) Compare the narrowband/ wideband systems (8)

4. Define vocoders. Explain the types of vocoders. (16)

5. (a) Define Multiple Access. Explain the types of MA techniques used in Wireless communication system. (8)
   (b). Explain the concept of CDMA. What are the merits & demerits? (8)

6. Explain in detail the excitation methods available in LPC. (16)

7. Draw the block Diagram of GSM Speech Encoder/decoder. Explain in detail. (16)

8. Explain the TDMA Frame structure & derive the efficiency and number of channels of a TDMA system. (16)

9. Explain the concept of FDMA & List out the nonlinear effects in FDMA. (16)

10. (a) What is SDMA? Explain in detail? (8)
    (b) If a normal GSM time slot consists of six trailing bits, 8.25 guard bits, 26 training bits, and two traffic bursts of 58 bits of data, find the frame efficiency. (8)

UNIT – V

WIRELESS SYSTEMS AND STANDARDS

PART-A

1. What is interoperator roaming?

2. Enumerate the various interfaces used in GSM?

3. What is the purpose of SIM?

4. What are the five functional entities of a DECT system?

5. What are the services of 3G WCDMA?

6. What are the benefits of WLL?

7. What is Bluetooth?

8. List out the three types of dedicated control channels in GSM

9. Write the frequency and channel specifications of IS-95 standard.

10. Enumerate the different types of common control channels.

11. What are the advantages of CCS over conventional Signaling?

12. What is the purpose of SS7 signaling?
PART-B

1. (a) Discuss the features and services of GSM
   (b) Explain the GSM system architecture with neat sketch.

2. Explain the GSM system channel types.

3. (a) Draw and Explain the Frame structure for GSM
   (b) Explain the Signal processing in GSM

4. Explain about forward and reverse traffic channel modulation process in CDMA Digital cellular standard

5. (a) Briefly explain the special features of CDMA cellular standard
   (b) Briefly explain Variable data rate transmission in reverse IS-95 channel with example

6. (a) Explain briefly about DECT layered Architecture
   (b) Briefly explain DECT functional concept and its applications

7. Explain about Bluetooth and how it is differ from WLAN

8. (a) Write short notes on wireless local loop (WLL)
   (b) Write short notes on IS-95B

9. (a) Explain in detail the traffic assignment process in AMPS.
   (b) Write short notes on AMPS Mobility Management.

10. Discuss the channels and cellular operation in Advanced mobile Phone Systems (AMPS).