Question Paper

Exam Date & Time: 27-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH (COMPUTER AND COMMUNICATION ENGINEERING) END SEMESTER EXAMINATIONS, MAY/JUNE 2023

WIRELESS COMMUNICATION AND COMPUTING [ICT 3272]

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Instructions to Candidates: Missing data may be suitably assumed

1) A mobile user is moving from Cell Site A to Cell site B at the speed of 63 km/hr. The radius of the cell site is 2000 meters with a path loss exponent of 3. Consider the time at which handoff occurs is 28 seconds. (5)

A)

i. Calculate the minimum required margin for handoff.

ii. Compute the distance at which handoff is initiated.

[Assume d0 = 1, P0 = 0dBm].

iii. Recalculate (i) if the duration over which handoff occurs is 5 seconds.

B) Suppose a person is moving from Udupi to Manipal in a bus and he/she is using a mobile station. Illustrate the attachment procedure of mobile station to serving GPRS support node in a general packet radio system. (3)

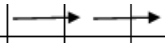
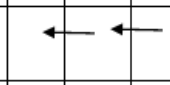
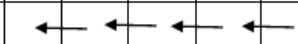
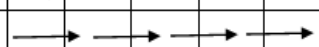
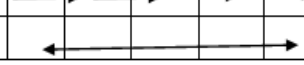
C) Discuss the reasons for the mobile users shifting from Wireless Application Protocol (WAP) to i-Mode service in cellular network (2)

2) The mobile call establishment procedure in a GSM network is shown in Table 2A. Identify mistakes in the table and plot correct sequence of it with a proper reason for each change. (5)

A)

Table: 2A

Steps	MS	BTS	BSC	BSS	MSC
1. Channel request	→	→	→		
2. Channel assigned	←	←			
3. Authentication request	→	→	→	→	
4. Authentication response	←	←	←	←	
5. Call establishment request	→	→	→	→	→
6. Send destination address	→	→	→	→	→
7. Routing response	←	←	←	←	←
8. Ciphering command	←	←	←	←	←
9. Ciphering ready	→	→	→	→	→

10. Assign traffic channel	
11. Traffic channel established	
12. Available/busy signal	
13. Call accepted	
14. Connection established	
15. Information exchange	

B) Elaborate the 6 factors that influence the penetration of cellular network is different in different countries. (3)

C) *Destination-Sequenced Distance Vector* routing algorithm is developed even though the distance vector routing algorithm exists. Why? Justify. (2)

3) Consider an access point/client emitting 900-MHz carrier frequency, it is affected only by thermal noise. The transmission power at access point Tx is 416 mW, client-side Tx is 83 mW, and cable loss at both side is 3 dB. Antenna gains at the access point and client sides are 18 dBi and 13 dBi respectively. The free space path loss for the coverage range of 5 km, the receiving sensitivity at the access point is -82 dBm, and the receiving sensitivity at client side is -73 dBm. Estimate the Rx signal level at access point and the link margin of the network. (5)

A)

B) A half-wave dipole antenna which is also a directional antenna, with an effective area of $(1.64 * \text{Lambda})^2/4\pi$ is used in place of a parabolic reflective antenna with a diameter of 2m. Evaluate the directional gain/loss resulting from the replacement if the Transmitter station is operating at 12 GHz. Note: Lambda is wavelength. (3)

C) Discuss the CDMA access scheme. Demonstrate the signal encoding and decoding for data 10110 with 3 users assigned. The chip-codes are 100101, 110011, and 110110 and assume chip codes are bipolar. (2)

4) Develop a transmission channel model for the following scenarios. (5)

A) Case 1: Discuss the effect of multipath and the spread that are to be accounted in the channel model depicted in Figure Q.4A

Case 2: Discuss the effect of additional path on the channel model if an additional reflector is placed d meters from the receiver in the direction of its movement.

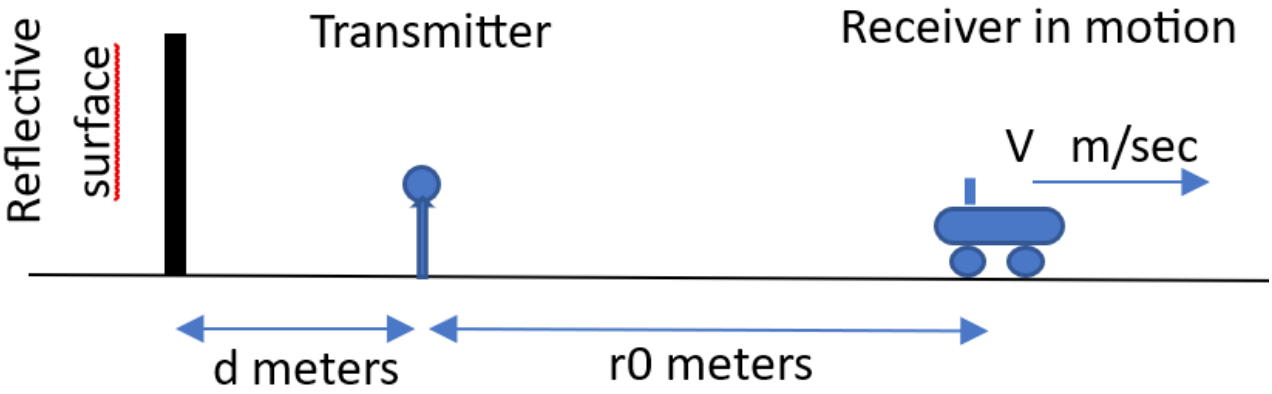


Figure Q.4A

B) Explain the concept of MFSK signaling. With neat frequency allocation diagram versus time, demonstrate the MFSK signaling for the bit stream 101010111001 with the symbol duration $T_s = 3*T_b$, where T_b represents one bit duration. (3)

C) Consider a base station is communicating with a receiver which is stationed at 6 km and operating at 2 GHz. For a 10 dBW transmitted power, evaluate the received signal power if total system loss is 8 dB, 5 dB Noise figure and the receiver bandwidth is 1.5 MHz. Assume the system is operating at 27-degree Celsius and Transmitter and receiver antenna gains are 8 dB and 0 dB respectively. (2)

5) Compare and contrast the fast and slow frequency hop spread spectrum techniques with the direct sequence spread spectrum methods. (5)

A)

B) Given the generator polynomial $G(X) = X^3+X+1$, draw the LFSR structure and prove that the sequence generated at the output of each shift register satisfies the maximum length pseudo-random properties. (3)

C) Assuming a PN generator produces the bit stream 110110001000111000101111, demonstrate the Fast FHSS method with 4-FSK data encoding method. For illustration assume the following: Input data 11001101001001, PN pattern changes at every T_c duration and $T_c = T_b$. (2)

-----End-----