

Code: AE76/AE127/AC127

Subject: WIRELESS AND MOBILE COMMUNICATIONS

**AMIETE – ET/CS (Current & New Scheme)**

Time: 3 Hours

**JUNE 2018**

Max. Marks: 100

*PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.*

**NOTE:** There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

**Q.1 Choose the correct or the best alternative in the following: (2×10)**

- a. 33MHz bandwidth is used for a particular cellular system using two 30KHz simplex channels to provide full duplex voice channels. Compute the number of duplex channels and how many simultaneous calls that can be supported per cell if the system uses TDMA with 8- way time multiplexing.
- (A) 550 duplex channels, 550 users                      (B) 1100 duplex channels, 550 users  
(C) 550 duplex channels, 4400 users                      (D) 1100 duplex channels, 4400 users
- b. If GSM uses a frame structure where each frame consists of eight time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833kbps in the channel, what is the duration of a bit & a slot.
- (A) 3.692 $\mu$ s & 0.577ms                                      (B) 3.692ms & 0.577ms  
(C) 3.692 $\mu$ s & 57.7ms                                        (D) 3.692 $\mu$ s & 5.77ms
- c. The cell site transmitter power increases by 3dB. It means it is increased approximately by \_\_\_\_\_.
- (A) Two times    (B) Four times  
(C) Three times    (D) None of these
- d. The differentiation between the carrier frequencies of the forward channels and reverse channels is an important design parameter related to \_\_\_\_\_.
- (A) FDMA    (B) CDMA  
(C) TDMA    (D) SDMA
- e. The difference between the received signal levels in an open area at two mobile subscribers located at 100meters and 1km away from a cell-site respectively (other factors remaining constant) is \_\_\_\_\_.
- (A) 20dB    (B) 40dB  
(C) 100dB    (D) 10dB

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- f. Few typical technical issues for proper design and planning of a cellular network are \_\_\_\_\_.
- (i) BS & MS Signal /power level  
(ii) Height of the antenna  
(iii) Radio coverage  
(iv) Geometric area .
- (A) (i), (ii) & (iv) only                      (B) (i), (ii), (iii) & (iv)  
(C) (i) & (iv) only                                (D) (i), (ii) & (iii) only
- g. \_\_\_\_\_ are used for cellular phone, satellite, and wireless LAN communications.
- (A) Radio waves                                      (B) Micro waves  
(C) Infrared waves                                 (D) None of these
- h. Slow fading occurs for \_\_\_\_\_.
- (A) Coherence time > Symbol period        (B) Coherence time < Symbol period  
(C) Coherence time  $\leq$  Symbol period        (D) Coherence time  $\geq$  Symbol period
- i. Find the far-field distance for an antenna with maximum dimension of 1m and operating frequency of 900 MHz
- (A) 3m     (B) 0.6m  
(C) 6m     (D) 0.3m
- j. Consider the design of the US Digital cellular equalizer. If  $f = 900$  MHz and the mobile velocity  $v = 80$  kmph, determine the Coherence time of the channel.
- (A) 6msec     (B) 6.34msec  
(C) 0.634msec                                      (D) 6.03msec

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**Answer any FIVE Questions out of EIGHT Questions.**  
**Each question carries 16 marks.**

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- Q.2** a. Explain the following terms with respect to mobile communication;                      (8)
- (i) Cell and cell cluster  
(ii) Handover and roaming
- b. A receiver in an Urban cellular radio system detects 1mW signal at  $d=d_0=1$  meter from the transmitter. In order to mitigate the co-channel interference effects, it is required that the signal received at any base station transmitter which operates with the same channel must be below -100dBm. A measurement team has detected that the average path loss exponent in the system is 3. Determine the major radius of each cell if a seven cell reuse pattern is used. What is the major radius if four cell reuse pattern is used?                                      (8)

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- Q.3** a. How is radio propagation on land different from that in free space? (8)
- b. Explain why channel coding reduces the bandwidth efficiency of the link. (4)
- c. Describe the concept of interleaver. (4)
- Q.4** a. Categorize the effect of path loss exponent on the frequency reuse for a cellular system with total of 550 duplex voice channels without frequency reuse. The service area is divided into 52 cells. The required signal to co-channel interference is 17dB. Consider the path loss exponent 3 & 4. Assume there are six co-channel cells in the first tier and all of them at the same distance from the mobile. Use suitable approximations. (8)
- b. Explain sectoring technique for the worst case forward channel interference using necessary equations. (8)
- Q.5** a. If  $W=1.25\text{MHz}$ ,  $R=9600\text{bps}$  and a minimum acceptable  $E_b/N_0$  is found to be 10dB, determine the maximum number of users that can be supported in a single cell CDMA system using (i) Omnidirectional base station antennas and no voice activity detection (ii) three sectors at the base station and activity detection with 3/8. Assume the system is interference limited. (8)
- b. Differentiate between TDMA and FDMA technique with relevant equations and diagram. (8)
- Q.6** a. Explain Handoff Strategy with neat diagram and equation. (8)
- b. What are the conditions for satellite path diversity? (8)
- Q.7** a. Explain GSM architecture with neat diagram. (8)
- b. Describe how pilot and paging channels are generated in IS-95. (8)
- Q.8** a. Explain the features and Applications of MANET ad-hoc networks. (6)
- b. Briefly explain Classification of Sensor networks with an example. (6)
- c. Explain COUGAR three-tier architecture. (4)
- Q.9** a. Write a note on Bluetooth personal area network. (8)
- b. With neat diagram explain the general MAC frame format. (8)