Name : ………………………………………………………

Roll No. : ………………………………………………………

Invigilator's Signature : ……………………………………

CS/M.Tech(ECE)/SEM-1/MCE-103/2009-10

2009

ADVANCED COMMUNICATION SYSTEM

*Time Allotted* : 3 Hours   Full Marks : 70

*The figures in the margin indicate full marks.*

Candidates are required to give their answers in their own words as far as practicable.

Answer question No. 1 and any *four* from the rest.

1. a) Why are both source coding and channel coding necessary in digital communication systems ?   2

    b) GSM can be treated as a system with TDMA/FDMA multiple access scheme — Justify.   2

    c) If $1\cdot2$ μ sec is the delay spread for a multi-path signal, what does this numerical value indicate ? If the surrounding object for a mobile receiver move fast, what effect would dominate small scale fading ? If V_s = velocity of source & V_r = velocity of the receiver, how these two parameters are related to account for Doppler Shift ?   3
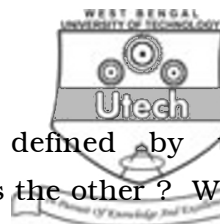
d) Small scale fading models are defined by two parameters. If one is distance, what is the other ? What are the order of magnitudes of these two parameters ? For a mobile receiver, even if the movement is small, what is the order of variation of the received signal in decibels ? Why so ? 3

2. a) What is 'cross-over' distance ? Deduce the expression for this distance. 5

b) Assume that a receiver is located at 10 kms. from a 50 W transmitter. The carrier frequency is 900 MHz, free space propagation is assumed and G_t = 1, G_r = 2. Determine (i) the power at the receiver ; (ii) the magnitude of the E-field at receiver antenna ; (iii) the rms voltage applied to the receiver input assuming that the receiver antenna is purely resistive with an impedance of 50 ohms and is matched to receiver.

2 + 3 + 2

c) Compare FDMA and TDMA techniques in terms of synchronization and fading. 3

3. a) Draw the block diagram of a typical GSM architecture and state the operations of (i) AUC ; (ii) GMSC ; (iii) BSC and (iv) A_{bis} interface. 5 + 4

b) Prove mathematically that the number of cells, N in a cluster in a cellular network is given by :

$N = i^2 + ij + j^2$, where i and j have their usual meanings. 6
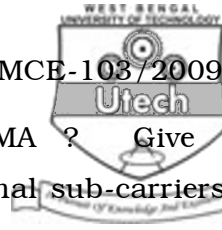
4. a) How does OFDM differ from FDMA ? Give the mathematical expression for orthogonal sub-carriers in OFDM. 4

   b) Generate the transceiver structures for OFDM using

   (i) analog technology and (ii) IFFT transformation. Explain the generation with the help of necessary equations. 3 + 3 + 5

5. a) "A Cordless Telephone is a Limited Mobility Telephone". Justify this statement & compare its performance with a GSM set. What type of modulation scheme is employed for these ? 3 + 1

   b) Fidelity of a signal indicates a very important performance aspect of a Radio Receiver. Explain this aspect. What impact does it have on the Digital Modulation techniques used in mobile communication ?

   2 + 2

   c) Explain the fundamentals of Channel Coding in Digital Modulation schemes. What are the basic purposes of introducing error detection and error correction techniques ? What are the fundamentals of Block Codes ? 3 + 2 + 2

6. a) Coherence Bandwidth & Coherence Time are two parameters used in connection with improving system performance in Fading Radio Channels using a Technique having three options. Explain this Technique. 6

b) In a GSM system, the TDMA / FDD system uses 25 MHz for the forward link, which is broken into radio channels of 200 kHz. If 8 speech channels are supported on a single radio channel and no guard band is assumed, find the number of simultaneous users that can be accommodated in GSM. 4

c) Some parameters are very important to be considered while designing an indoor propagation model for mobile transmission. Inside buildings with varied décor. Explain these parameters highlighting the special features. 5

7. a) Spread spectrum technique is used for CDMA technology. What are its special features that as made this extremely useful in aspects like noise reduction. Explain this scheme. 2 + 3

b) A CDMA scheme has got certain distinct advantage over GSM. Highlight some important distinctive features. What is a RAKE receiver ? 3 + 2

c) A total of 33 MHz 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 (i) 7 cell reuse (ii) 12 cell reuse. 5