53 (EC 605) MBCM

2017

MOBILE COMMUNICATION

Paper : EC-605

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer questions no. ***1*** *and* ***any four*** *from the rest.*

1. Answer ***all*** the questions :

   (a) Out of the following options which one is not true about Wireless Communication ? 1

   (i) Wireless channel is more noisy than wired channel.

   (ii) Mobile communication is an application of wireless communication.

(iii) Digital modulation techniques are not required in wireless communication.

(iv) A diversity mechanism helps to reduce the effect of noise in wireless channel.

(b) First generation cellular service is 1

(i) AMPS

(ii) GPRS

(iii) EDGE

(iv) CDMA

(c) Full form of AMPS is ————————. 1

(d) The uplink and downlink frequency band in 2G voice communication are ———— *MHz* and ———— *MHz* respectively in India. 2

(e) Which of the following diversity mechanism does not waste the resource ? 1

(i) Time diversity

(ii) Frequency diversity

(iii) Space diversity

(iv) Code diversity.

(f) A hexagonal cellular system has a cluster size 19. If the cell radius is 1 *km*, what is the distance between two co-channel cells. 2

(g) If the signal bandwidth is more than the channel coherrent bandwidth, it causes 2

(i) slow fading

(ii) fast fading

(iii) frequency selective fading

(iv) None of these.

(h) In a cellular system, if the cell radius and transmitted power are made half, the received power at mobile 2

(i) remain unchanged

(ii) will be half

(iii) will be doubled

(iv) cannot be predicted.

(i) Full form of GSM is ———————. 1

(j) What is the auto correlation and cross correlation of a PN sequence ? 2

(k) Maximum data rate of GPRS is ———————. 1

(l) A mobile station has a signal to co-channel interference ratio of 30*dB*. If the cellular system is sectorized as 3 sectors/cell without changing other parameters, what will be the SIR of the mobile station ? 2

(m) Full form of GPRS is ————————. 1

(n) Full form of MSC is ————————. 1

2. (a) Explain the advantages and challenges of the wireless communication. 5

(b) With neat graphical diagram prove that frequency reuse ration in a hexagonal cellular system, $D/R=\sqrt{3N}$. 6

(c) What is co-channel-interference ? Derive with neat diagram, the SIR of a hexagonal cellular system without assuming any sectorized antenna. 2+7

3. (a) Derive the relation between transmitted and received power in *dB* scale and explain the importance of all the components. 8

(b) Assuming a receiver is located $10km$ from a $50W$ transmitter, the carrier frequency is $1900MHz$, free space propagation is assumed, $G_t = 1$, $G_r = 2$, find :
(a) the power at receiver (b) the magnitude of the E-field at the receiver antenna. (c) Find the received power at the mobile using the two ray ground reflected model assuming that the height of the transmitting antenna is $50m$, receiving antenna is $1{\cdot}5m$ above the ground, and the ground reflection is -1. 4+3+5

4. (a) Name the different channel parameters and explain relation between them. 10

(b) Determine the proper spatial sampling interval required to make small scale propagation measurements which asume that consecutive samples are highly correlated in time. How many samples will be required over $10mt$ travel distance if $f_e = 1900MHz$ and $v = 50mt/sec$. How long would it take to make these measurements, assuming they could be made in real time from a moving vehicle ? What is the Dopplar spread B_D for the channel ? 6

(c) Describe the difference between time selective and frequency selective fading. 4

5. (a) Explain the need of diversity receiver and equalizer. Under what circumstances these are used ? 5

(b) In a Rayleigh faded channel, show that the SNR improvement using Selection Diversity is $\frac{\bar{\gamma}}{J} = \sum_{k=1}^{M} 1/k$. 10

Where $\bar{\gamma}$ is average instantaneous SNR. J is the average SNR. M is the number of diversity branches.

(c) Consider the design of the US digital cellular equalizer. If $f = 900\,MHz$ and the mobile velocity $v = 80\,km/hr$. Determine the following 2½×2

(a) the maximum Doppler shift.

(b) the coherence time of the channel.

6. (a) Describe the properties of PN sequences. Explain how it helps to reduce interference and jamming. 10

(b) What is the Multi-Access-Interference (MAI) in CDMA ? Derive the expression of MAI and show how it affects on bit error rate of a BPSK system. 10

7. Write short notes on : ***(Any two)*** 10×2

(i) GSM Architecture

(ii) Cell splitting

(iii) GPRS

(iv) Linear equalizer.