53 (EC 615) MBCM

2019

MOBILE COMMUNICATIONS

Paper : EC 615

Full Marks : 100

Time : Three hours

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

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

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

   (a) What is the first cellular communication standard in the European Countries ?

   (i) AMPS

   (ii) ETACS

   (iii) IS-95

   (iv) GSM 1

   (b) AMPS cellular system has a channel bandwidth of 30*kHZ*. *(True/False)* 1

(c) If the distance between two co-channel cells is increased, cellular capacity is increased. *(True/False)* 1

(d) A 7-cell cluster has a cell radius of 1*km*. What is the distance between 2 co-channel cells? 2

(e) What are the false statements about Sectorization? 2

(i) Sectorization increases signal to interference ratio.

(ii) Sectorization leads to less hand-off.

(iii) Sectorization uses many directive antennas, hence more power is required for a transmitter.

(iv) It involves MSC more compared to an unsectored cell.

(f) A spectrum of 30*MHz* is allocated to a wireless FDD cellular system which uses two 25*kHz* simplex channels to provide full duplex voice. Number of available channels per cell for a 7-cell cluster will be — 2

(i) 150

(ii) 85

(iii) 170

(iv) 50.

(g) In free-space signal, attenuation rate is –6*dB*/octave. *(True/False)* 1

(h) Signal can cover longer distance over water. *(True/False)* 1

(i) A car is moving at a velocity of 100*km/hr* from a base station. Base station transmits signal to the car at 900*MHz* carrier frequency. The Doppler spread will be — 2

(i) 83*Hz*

(ii) 9*Hz*

(iii) 132*Hz*

(iv) 264*Hz*.

(j) If the signal bandwidth is lesser than the channel bandwidth, it causes — 1

(i) Slow fading

(ii) Fast fading

(iii) Frequency selective fading

(iv) None of the above.

(k) A channel has a doppler spread of 50*Hz*. What is the coherence time if we assume time correlation function is above ·5 ? 2

(i) 3·58*msec*

(ii) ·02 *sec*

(iii) 5·68*msec*

(iv) ·002*sec*.

(l) Received wireless signal which has a line-of-sight component has the following distribution : 1

(i) Gaussian distribution

(ii) Uniform distribution

(iii) Rayleigh distribution

(iv) Rician distribution.

(m) Which among following modulation techniques has lesser side lobe power ? 1

(i) FSK

(ii) PSK

(iii) MSK

(iv) GMSK.

(n) Maximum possible data rate in GPRS is — 1

(i) 115·2*kbps*

(ii) 2*Mbps*

(iii) 230.4*kbps*

(iv) 14.4*kbps*.

(o) AMPS is a communication technology which uses : 1

(i) TDD/FDMA

(ii) TDD/TDMA

(iii) FDD/TDMA

(iv) FDD/FDMA.

2. (a) State the advantages and limitations of cellular communication. 4+3

(b) Define co-channel interference and signal to co-channel interference ratio. 2+2

(c) Calculate SIR in worst case scenario for a 19 cell cluster. Find the worst case SIR for $n = 2, 3, 4$ where n is path channel exponent. 9

3. *(a)* Derive the relation between transmitter and receiver power in free-space and with omnidirectional antenna. 8

(b) State how the above relation is changed when the medium is flat on open area. 8

(c) If $P_t = 20W$, $G_t = 1$, $G_r = 2dB$ and $f_c = 900MHz$, find the received power P_r per unit area. 4

4. *(a)* The local average power-delay profile in a particular environment is found to be

$$P(\tau) = \sum_{n=0}^{i} \frac{10^{-6}}{n^2+1} \delta\left(\tau - n \cdot 10^{-6}\right)$$

(a) Sketch the power delay profile of the channel in *dBm*.

(b) What is the local average power in *dBm*?

(c) What is the r.m.s. delay spread of the channel?

(d) If 256 QAM modulation having a bit rate of 2*Mbps* is applied to the channel, will the modulation undergo flat or frequency selective fading? Explain your answer. 2+2+2+3

(b) Define Fading. Explain nature and types of fading with respect to the relation between channel parameters. 11

5. *(a)* What is a diversity receiver? Define different types of diversities. 2+6

(b) Derive the expression of SNR improvement in selection combining technique. 8

(c) In which channel condition an equalizer is needed? Name different types of equalizers used in wireless communication. 4

6. *(a)* State the differences between multiplexing and multiple access. 1

(b) Derive frame efficiency of TDMA. 5

(c) State the properties of spread-spectrum sequence. 8

(d) Define the following : 6

(i) Set-up channel

(ii) Voice channel

(iii) Control channel.

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

(i) GPRS

(ii) Decision Feedback Equalizer

(iii) GSM architecture

(iv) CDMA.