

2056
B.E. (Electrical and Electronics Engineering)
Eighth Semester
OE-EE-802: Wireless Communication

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.

x-x-x

I. Answer the following :-

- Discuss the advantages of HSDPA over conventional UMTS systems.
- How does interleaving help in burst error correction?
- Explain Basic Rate Interface vs Primary Rate Interface in ISDN?
- A mobile move toward base station at 60 km/h, frequency = 2 GHz. Find received frequency.
- A system has cluster size $N=7$ and cell radius $R=1$ km. Find reuse distance. (5x2)

UNIT - I

- Explain the architecture of 4G LTE networks with a neat diagram. Compare 4G and 5G systems in terms of speed, latency, bandwidth, and applications.
 - A cellular system initially uses omnidirectional antennas with: Cluster size $N=7$, Path loss exponent $n=4$. To reduce co-channel interference, the system adopts 120° sectoring. Assuming the number of interferers reduces from 6 to 2, calculate: (i) Initial signal to interference ratio (SIR), (ii) New SIR after sectoring (iii) Improvement in SIR in dB and (iv) Explain how sectoring improves system performance.) (2x5)
- Explain the working principle of frequency hopping spread spectrum (FHSS) in Bluetooth. Compare Bluetooth, ZigBee and RF communication technologies.
 - Explain the practical considerations involved in handoff management. A train moves at a speed = 320 km/h. The cellular network uses: Cell radius = 1 km Determine: (i) Average time spent inside a cell (ii) Number of handoffs during a 2-hour journey and (iii) Challenges faced in maintaining seamless connectivity. (2x5)
- Explain the concept of constellation diagrams. Draw and explain constellation diagrams of ASK, BPSK, QPSK, BFSK and MSK.
 - A wireless channel has: RMS delay spread = 8 μ s. A digital communication system transmits: Symbol duration = 5 μ s and Signal bandwidth = 500 kHz. Determine: (i) Approximate coherence bandwidth (B_c) $B_c \approx 1/5\tau$, (ii) Whether the channel experiences flat fading or frequency selective fading and (iii) Whether intersymbol interference will occur. (2x5)

(2)

UNIT - II

- V. a) Explain why Maximal Ratio Combining (MRC) provides better performance than selection combining. And derive output SNR expression for MRC.
- b) A GSM-like cellular communication system has the following parameters: Total allocated spectrum = 50 MHz, Duplex spacing = 45 MHz, Channel bandwidth = 200 kHz, Guard band = 20 kHz per channel, TDMA slots per carrier = 8, Cluster size $N=7$, Total number of cells in the network = 49. Determine: (i) Total simplex channels available (ii) Total duplex channels available (iii) Number of carriers per cell (iv) Number of traffic users supported per cell, (v) Total users supported in the entire network and (vi) Spectral efficiency if each user data rate is 13 kbps. (2x5)

- VI. a) A (7,4) linear block code uses the generator matrix:

$$[G] = \begin{bmatrix} 1000110 \\ 0100101 \\ 0010011 \\ 0001111 \end{bmatrix}$$

Message vector: $m=[1011]$. During transmission bit 5 gets corrupted. Determine:

- (i) Encoded codeword (ii) Received vector (iii) Syndrome vector (iv) Error position (v) Corrected codeword and (vi) Original message bits
- b) Explain traffic channels and control channels in GSM frame organisation. A GSM system has the following parameters: (i) One TDMA frame duration = 4.615ms, (ii) Number of time slots per frame = 8, (iii) One traffic multiframe contains = 26 TDMA frames, (iv) One control multiframe contains = 51 TDMA frames and (v) One superframe contains = 1326 TDMA frames. Determine: (i) Duration of one time slot, (ii) Number of TDMA frames transmitted per second, (iii) Duration of one traffic multiframe, (iv) Duration of one control multiframe, (v) Number of time slots in one superframe and (vi) Duration of one superframe. (2x5)
- VII. a) Discuss architecture and operation of Signaling System No. 7 (SS7) in modern telecom networks. Analyze congestion control mechanisms in SS7 networks.
- b) Explain impact of multipath fading on forward and reverse CDMA channels. Analyze soft handoff mechanism and its advantage over hard handoff?

(2x5)