Institute of Information Technology

Jahangirnagar University
Professional Masters in IT

Do not write anything on the question paper.
There are **7 (Seven)** questions. Answer any **5 (Five)** of them

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1. a) "FDMA wastes bandwidth", How? Explain. Do you agree "TDMA is a complimentary access technique to FDMA"? If you agree then show your logic. **4**

   b) "Wireless LANs can operate in one of two configurations, with a base station and without a base station". Explain this statement. **4**

   c) Describe the layers of Bluetooth Network. **4**

2. a) In the GSM800 digital channelized cellular system, the one-way bandwidth of the system is 12.5 MHz. The RF channel spacing is 200 kHZ. Eight users share each RF channel and three channels per cell are used for control channels. Calculate the spectral efficiency of modulation (for a dense metropolitan area with small cells) using the following parameters: **6**
   - Area of a cell=8 km^2
   - Total coverage area =4000km^2
   - Average number of calls per user during the busy hour= 1.2
   - Average holding time of a call=100 seconds
   - Call blocking probability=3%
   - Frequency reuse factor=7

   b) Define Cell Capacity of a TDMA System. Now calculate the capacity and spectral efficiency of a TDMA system using the following parameters: bandwidth efficiency factor η_b= 0.9, bit efficiency (with QPSK) μ=2, voice activity factor v_f =1.0, one-way system bandwidth B_w =12.5 MHz, information bit rate R =16.2 kbps, and frequency reuse factor N = 19. **6**

3. a) If GSM uses a frame structure where each frame consists of 8 time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833 kbps in the channel, find (a) the time duration of a bit, (b) the time duration of a slot, (c) the time duration of a frame, and (d) how long must a user occupying a single time slot must wait between two simultaneous transmissions. **4**

   b) Mention some features of Narrow-band signals and Spread Spectrum Signals **4**

   c) **Draw and describe general Model of Spread Spectrum System. Whether** CDMA is a Direct Sequence Spread Spectrum system? Or not Explain. **4**

4. a) What is **linear-feedback shift register?** Draw a 16-bit Fibonacci LFSR. If the seed is 1010110011100110. Find the pseudo-noise sequences for four rounds. **6**

   b) The access method of MAC protocol of IEEE 802.11 based on exponential binary backoff algorithm. Explain the algorithm. **6**

5. a) What do you mean by Multipath propagation? How does it cause harmful interference to the signal? Explain with generating environment for urban area. 6

    b) Why cells are hexagonal? For a hexagonal geometry, evaluate the co-channel reuse ratio is: $q = \sqrt{3N}$. 6

6. a) If the bandwidth for 8-QAM and 8-PSK is BW=2Rb/3, then what is the bandwidth of 16-QAM and 16-PSK? If a bit stream of 64 kb/s is to be transmitted, how much bandwidth is required in each case? 6
    How many symbols are represented (M) for 8-QAM and 16- QAM modulation?
    How many bits per symbol are used (K) for 8-PSK and 16-PSK?
    If the Baud is 10000 symbols/s, what is bit rate (Rb) for 8-QAM and 16-QAM?
    Would 16-QAM be more or less susceptible to noise than 16-PSK modulation?
    Draw the signal constellation diagram for both 16-QAM and 16-PSK.

    b) Draw a baseband OFDM transmission model. Proof the statement "When integrating received power over one symbol period, T_u, the output of the correlators is zero for any combination, except when $k = q$" 6

7. a)   6
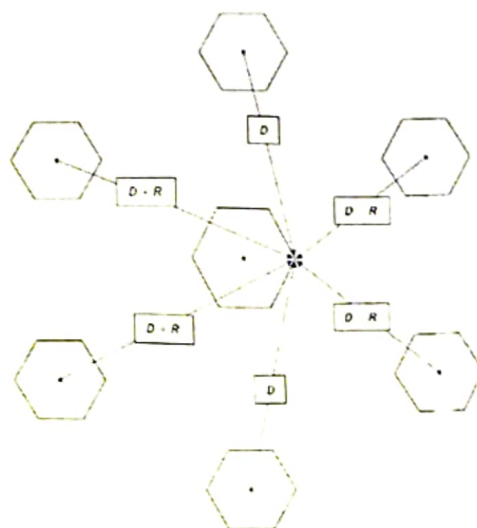
    Calculate the signal to interference ratio (S/I) from the above worst-case scenario for co-channel interference.
    If we assume the reuse distance D is same for six interfering cells then S/I=?
    If the cell is divided into six sectors by using a 60^0 beam then what is the impact on Co-channel interference?

    b) A city has total population of 5,00,000. A network planar found the behavior of users of the city like: they generate 3 calls/hour with average holding time of 2 minutes. The service provider got the license of BW that can support 36 carriers of GSM. Determine number of sectors of 3/9 cell pattern maintaining GoS of 5%. 3

    c) Explain the Destination-Sequenced Distance Vector (DSDV) Packet Process Algorithm with example. 3