



Institute of Information Technology  
Jahangirnagar University  
Professional Masters in IT

1<sup>st</sup> Semester Final Examination Summer 2022

Duration: 3 Hours

Course Code: PMIT 6217

Intake : Summer 2022, Spring 2022

Full Marks: 60

Course Title: Wireless Network

**Do not write anything on the question paper.**

There are 7 **(Seven)** questions. Answer any 5 **(Five)** of them.

Figures in the right margin indicate marks.

1. a) Define Wireless Network. Mention devices commonly used for wireless networking. Why do we need this new technology when we have such a developed public telephone network? 4
- b) Explain infrastructure mode in detail by drawing Mobile Networks. 4
- c) Describe the layers of Bluetooth Network. 4
2. a) Explain about IrDA and ZigBee 4
- b) Described briefly 4 features of TDMA 4
- c) 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: 4
  - Area of a cell =  $9 \text{ km}^2$
  - Total coverage area =  $4500 \text{ km}^2$
  - Average number of calls per user during the busy hour = 1.2
  - Average holding time of a call = 120 seconds
  - Call blocking probability = 2%Frequency reuse factor = 7
3. a) 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  $\eta_b = 0.9$ , bit efficiency (with QPSK)  $\mu = 2$ , voice activity factor  $v_f = 1.0$ , one-way system bandwidth  $B_w = 12.5 \text{ MHz}$ , information bit rate  $R = 16.2 \text{ kbps}$ , and frequency reuse factor  $N = 19$ . 4
- b) 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
- 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) Explain "near-far" problem. 4



- b) The access method of MAC protocol of IEEE 802.11 based on exponential binary backoff algorithm. Explain the algorithm. 4
- c) Types of frequency hopping are: (i) Slow frequency hopping (ii) Fast frequency hopping. Explain both. 4
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. 4
- b) "For a given SNR, a modulation technique with a higher bit transmission rate will have a higher BER" Explain. 4
- c) Consider a GSM system with a one-way spectrum of 12.5 MHz and channel spacing of 200 kHz. There are 3 control channels per cell and reuse factor is 7. Assuming an Omnidirectional antenna with 6 interferers in the first tier and a slop path loss of 40 dB/decade, calculate the number of calls per hour per cell site with 2% blocking during the system busy hour and an average call holding time is 120 seconds, The GSM uses 8 voice channels per RF channel. 4
6. a) Why cells are hexagonal? For a hexagonal geometry, evaluate the co-channel reuse ratio is:  $q = \sqrt{3N}$ . 4
- b) If the bandwidth for 8-QAM and 8-PSK is  $BW=2R_b/3$ , 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? 4
- 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 ( $R_b$ ) 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.
- c) 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  $k = q$ " 4
7. a) Calculate the signal to interference ratio (S/I) from the worst-case scenario for co-channel interference. 6
- 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  $60^\circ$  beam then what is the impact on Co-channel interference?
- b) A city has total population of 45,00,000. A network planar found the behavior of users of the city like: they generate 2 calls/hour with average holding time of 1.5 minutes. The service provider got the license of BW that can support 27 carriers of GSM. Determine number of sectors of 3/9 cell pattern maintaining GoS of 2%. 3
- c) Explain the LEACH Clustering Protocol 3