



Institute of Information Technology  
Jahangirnagar University  
Professional Masters in IT

Final Examination  
Duration: 3 Hours  
Course Code: PMIT 6217

Semester: First Semester  
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) "There is continuous flow of energy from electrical field to the magnetic field." Explain the statement 4  
b) "FDMA wastes bandwidth", How? Explain. Do you agree "TDMA is a complimentary access technique to FDMA"? If you agree then show your logic. 4  
c) Mention some open research topics and explain two of them 4
2. a) Explain **IrDA and Zigbee** technologies 4  
b) Access points can serve a varying number of computers using DHCP. 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=8 km<sup>2</sup>
  - Total coverage area =4000km<sup>2</sup>
  - 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
3. a) Hand-off Provides continuity of communication across cells. Explain the statement. Why should we provide a higher priority to handoff calls? 4  
b) Explain Spread spectrum multiple access (SSMA). When a user will experience "near-far" problem for SSMA? How can it be mitigated? 4  
c) 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  $B_w = 12.5$  MHz, information bit-rate  $R = 16.2$  kbps, and frequency reuse factor  $N = 19$ . 4
4. a) What is **linear-feedback shift register**? Draw a 4-bit Fibonacci LFSR. 4  
b) Draw the Flow Chart of CSMA/CD-Algorithm 4  
c) OFDM offers many advantages over single-carrier modulations. mention those advantages 4

5. a) Show the graph for the probability that a transmitted bit is received in error at the receiver—versus the SNR for three different modulation techniques BPSK QAM16 and QAM 256 4
- b) What do you mean by Multipath propagation? How does it cause harmful interference to the signal? Explain with generating environment for urban area. 4
- c) Explain frequency reuse pattern. For a hexagonal geometry, evaluate the co-channel reuse ratio is:  $q = \sqrt{3N}$ . 4
6. a) "Hybrid **Modulation** systems exist where two characteristics are changed with each new symbol transmitted" Explain with example 4
- 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  $k = q$ " 4
- c) If a normal GS time slot consists of 6 trailing bits, 825 guard bits, 26 training bits, and 2 traffic bursts of 58 bits of data, find the frame efficiency 4
7. a) Calculate S/I ratio for Worst case scenario in three sectors when cluster size  $N=7$  and  $N=12$  4
- 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%. 4
- c) Explain the Destination-Sequenced Distance Vector (DSDV) Packet Process Algorithm with example. 4



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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) "There is continuous flow of energy from electrical field to the magnetic field." Explain the statement. Show 6 scenarios which present a specific challenge or problem that comes up when working with wireless equipment. 4  
c) Draw and describe the Architecture of the LAN and MAN (WiFi- and WiMAX) integrated network. 4
2. a) Explain about IEEE 802.15.3 standard and Explain about IEEE 802.15.4 standard 4  
b) "FDMA wastes bandwidth", How? Explain. Do you agree "TDMA is a complimentary access technique to FDMA"? If you agree then show your logic. 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 = 12
3. a) "Hand-off Provides continuity of communication across cells", Explain the statement. Now briefly explain about the mechanism of Hard handover. 4  
b) Explain Infrared LANs. The use of infrared has several advantages, Mention some of these advantages and also write one major disadvantage of infrared technology. 4  
c) 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
4. a) Explain "near-far" problem. When a user will experience "near-far" problem for CDMA, how can it be mitigated using close loop power control technique? 4



- b) Explain the LEACH Clustering Protocol 4
- c) What do you mean by Multipath propagation? How does it cause harmful interference to the signal? Explain with generating environment for urban area. 4

OR

Assume a system of 32 cells with a cell radius of 1.6 km, a total of 32 cells, a total frequency bandwidth that supports 336 traffic channels, and a reuse factor of  $N = 7$ . (a) If there are 32 total cells, what geographic area is covered, how many channels are there per cell, and what is the total number of concurrent calls that can be handled? (b) Repeat for a cell radius of 0.8 km and 128 cells

5. a) Draw and describe general Model of Spread Spectrum System. Whether CDMA is a Direct Sequence Spread Spectrum system? Or not Explain 4
- b) Show the graph for the probability that a transmitted bit is received in error at the receiver—versus the SNR for three different modulation techniques BPSK, QAM16 and QAM 256. Now explain at least two Wireless Link Characteristics: Physical-layer characteristics according to the curve. 4
- c) Calculate the signal to interference ratio (S/I) from the worst-case scenario for co-channel interference if cluster sizes are  $N=7$  and  $N=12$  when Omnidirectional antenna is used. If we assume the reuse distance  $D$  is same for six interfering cells then  $S/I=?$  for the same sizes 4
6. a) What are the advantages of designing hexagonal cells? Explain the relationship between  $D$  and  $N$  from the equation:  $D = \sqrt{3NR}$  4
- b) "From a design viewpoint, the smallest possible value of  $N$  is desirable in order to maximize capacity over a given coverage area" Explain the statement with example 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
7. a) Explain Fibonacci linear-feedback shift register. 4
- b) To overcome some limitations like co-channel interference, cell sectoring is widely used. Explain three cell sector technique calculating S/I for  $N=7$  and  $N=12$  when three directional antenna is used. 4
- c) 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%. 4