ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANIZATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Information Technology (CIT)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2010-2011**

DURATION: 3 Hours **FULL MARKS: 150**

CIT 4409: Data and Telecommunications

Programmable calculators are not allowed. Do not write anything on the question paper.

There are 8 (eight) questions. Answer any 6 (six) of them.

Figures in the right margin indicate marks.

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1. a) What is data communication? How data flow can be categorized in data communication? Define protocol and its key elements. 1+3+4

   b) Both OSI model and TCP/IP protocol suite are defined as layered network model in order to facilitate and organize different tasks to different layers. What are their differences? 5

   c) Write the tasks of session, presentation and transport layer of OSI model. Describe the protocols of Network layer in TCP/IP. 6+6

2. a) Write short note on the following terms: 10
   i. Constellation diagram ii. Datagram iii. Internet
   iv. Frequency modulation v. Block coding

   b) Draw diagrams in Time domain and corresponding Frequency domain for periodic and non-periodic analog and digital signals. 8

   c) What is the maximum theoretical data rate in a channel without noise and with noise? Explain how the data rate can be increased in both cases. What is the required SNR to achieve maximum data rate of 24 Mbps in a 2 MHz bandwidth channel? 3+4

3. a) Prove that a digital signal is actually a composite analog signal. 5

   b) What is line coding? Differentiate among unipolar, polar, and biphase line coding schemes. 2+8

   c) Draw corresponding digital signal for the bit stream 001101001 using the following line coding schemes: 10
   i. NRZ-I ii. Polar RZ iii. Manchester
   iv. AMI v. Pseudoternary

4. a) What is multiplexing? Compare between Frequency Division Multiplexing and Time Division Multiplexing. 2+5

   b) Define spread spectrum and its goal. Briefly describe Frequency Hopping Spread Spectrum technique with related figures and explain the reason of using this technique though it requires a lot of bandwidth. 2+10

   c) In your opinion, which one is better for data transfer between twisted pair cable and coaxial cable and why? Why two wires are kept twisted instead of parallel in twisted-pair cable. 3+3

5. a) Mention the name of the connectors used in twisted-pair, coaxial and fiber optic cable. 6

b) Write short notes on three wireless transmission techniques (mentioning their important characteristics): 9
i. Radio wave, ii. Microwave, iii. Infrared

c) Draw the timing diagrams and distinguish circuit switching, datagram, and virtual circuit networks. 10

6. a) Discuss the major components and signaling mechanism of a telephone network. How dial-up modems are used in the telephone network for data transfer? 4+3

b) What is the importance of SS7 in telephone network? Mention the tasks and protocols for each layer of SS7 protocol. Use proper diagrams if needed. 5+4

c) What is DSL technology for data transfer? How cable TV network can be used for data transfer? 2+7

7. a) Define Hamming distance. How minimum Hamming distance helps you to determine the number of bits of error that can be detected or corrected for any coding scheme? 5

b) How many bits of errors can be detected and corrected by simple-parity check code? Mention the strategy used by two-dimensional parity check code that can detect few more bits. How a burst error of 4 bits can be detected by the same coding technique? 1+5+6

c) What is CRC? Given the dataword $x^7+x^4+x^2+x+1$ and divisor x^4+x^2+x+1, show the generation of codeword in the sender and the checking of the codeword in the receiver assuming no bit error. 8

8. a) What is HDLC? Draw the frame structures used in this protocol and how can they be identified? What is the use of poll/final bit? 2+4+2

b) Draw timing diagram showing packet flow for three error control techniques used in data link layer ARQ protocols showing two erroneous scenarios: 5+5
i. Data frame is lost ii. ACK is lost.

c) Compare among hub, Layer-2 switch, and router used in connecting LANs. 7