ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2015-2016**

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

CSE 4405: 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 are de facto and de jure standards? Briefly discuss the procedure for getting an Internet standard. 8

   b) In computer network different types of addressing is used. Explain the concept of these addresses with proper examples. Mention the appropriate layers of the TCP/IP protocol suite in which these addresses work. 7

   c) Suppose you have to create a Local Area Network (LAN) for CSE department with 10 rooms and 30 faculties where 3 faculties sit in each room and each of them uses his/her own workstation. Which topology will you use for creating a LAN for such a small office environment? How many cables will be required? Provide appropriate figures and justify your selection of topology. 10

2. a) What is baseline wandering? How can this problem be solved? 5

   b) What do you mean by digital and analog hierarchy? Explain the digital hierarchy with the help of a figure that depicts the digital signal (DS) from DS-0 to DS-4 along with its capacity 2+8

   c) Consider the bit stream: 010011. Draw corresponding digital signal for the following line coding schemes: 10
      i. NRZ-I
      ii. Manchester
      iii. Differential Manchester
      iv. 2B1Q
      v. AMI

3. a) Write short notes on the application of Nyquist and Shannon capacity formulae in data and telecommunications with example. 3+3

   b) What is the total delay for a frame of size 7 million bits that is being sent on a link with 8 routers each having a queuing time 2.5 microseconds and a processing time of 1.5 microseconds? The length of the link is 12000 km. The speed of light inside the link is $2X10^8$ m/s. The link has a bandwidth of 15 Mbps. Which component of the total delay is dominant? Which one is negligible? Discuss briefly. 8+2

   c) What is DC component in digital signal? Explain the time and frequency domain concepts of signal transmission. 2+7

4. a) Why do we use multiplexing for efficient utilization of bandwidth? Explain in your own words. Is there any other technique for efficient utilization of bandwidth? Discuss briefly. 3+3

   b) Briefly explain the concept of statistical time division multiplexing with necessary diagram if required. 9

   c) We need to use synchronous TDM and combine 25 digital sources, each of 1000 kbps. Each 5x2

output slot carries 10 bits from each digital source, but two extra bits is added to each frame for synchronization. Answer the following questions:

i. What is the size of an output frame in bits?
ii. What is the output frame rate?
iii. What is the duration of an output frame?
iv. What is the output data rate?
v. What is the efficiency of the system?

5. a) Name different types of connectors for twisted pair, co-axial and fiber optic cables. 3
   b) What is VSAT? How do you use VSAT technology for secure and private communication between two hi-tech offices of an organization? 2+7
   c) What are the different ways of wireless transmission? What are the technical advantages of using twist in the twisted pair cable? 3+5
   d) How does sky propagation differ from line-of-sight propagation? Name the advantage of optical fiber over twisted pair and coaxial cable. 2+3

6. a) What is Hamming distance? Calculate the Hamming pairwise distances among the following codewords: 2+6
      i. 00000, 10101, 01010
      ii. 000000, 010101, 101010, 110110
   b) A CRC is constructed to generate a 4-bit FCS for an 11-bit message. The generator polynomial is X^4+X^3+1. 12
      i. Draw the shift register circuit that would perform this task.
      ii. Encode the data bit sequence 10011011100 using the generator polynomial and give the codeword.
      iii. Now assume that bit 7 (counting from the LSB) in the codeword is in error and show that the detection algorithm detects the error.
   c) Discus simple parity check code and two-dimensional parity check. 5

7. a) How does the switched communication network work? What are the different components of a soft switch? Explain briefly. 5+5
   b) What are the advantages of packet switching compared to circuit switching? Compare and contrast datagram and virtual circuit operation. 7
   c) There is a significant relationship between packet size and transmission time. It is assumed that there is virtual circuit from station X through nodes a and b to station Y. The message to be sent is 40 octets and each packet contains 3 octets of control information. Consider different scenarios where the message has been segmented into 1-packet, 2-packet, 5-packet and 10-packet. Explain the effect of packet size on transmission for the above mentioned scenario with necessary diagram. 8

8. a) What are the application areas of microwave communication? Explain single bit error and burst error. 2+5
   b) Briefly discuss the single mode and multimode propagation of fiber-optic cable with necessary figures. 8
   c) Discuss the importance of line coding in digital transmission. Explain different types of transmission impairments in data and telecommunication. 3+7