

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

**MID SEMESTER EXAMINATION****SUMMER SEMESTER, 2020-2021****DURATION: 1 HOUR 30 MINUTES****FULL MARKS: 100****CSE 4405: Data and Telecommunications****Programmable calculators are not allowed. Do not write anything on the question paper.**

Answer **all** of the **3 (three)** questions. Marks of each question and corresponding CO are written in the right margin with brackets. Write **Student ID, Name, and the page number** on every page of the answer script. Upload the answer script named **Full\_Student\_ID<space>Course Code.pdf**

1. a) What are the layers in the OSI model? Explain the following in terms of the TCP/IP protocol suite. 2+9  
(CO1)
    - i. Process to process delivery
    - ii. Host to host delivery
    - iii. Node to node delivery

OR

Briefly explain the necessity of layering in designing a communication system. Match the following to one or more layers of the OSI model: 6+5  
(CO1)

i. Line configuration	ii. Error control	iii. Framing	iv. Addressing
v. Connection control			
  - b) For each of the following four networks, discuss the consequences if a connection fails. 6+4  
(CO1)
    - i. Five devices arranged in a mesh topology
    - ii. Five devices arranged in a star topology
    - iii. Five devices arranged in a bus topology
    - iv. Five devices arranged in a ring topology.

For  $N$  devices in a network, what are the numbers of cable links required for each of the topologies? (The value of  $N$  should be calculated from your student ID using the following formula.  $N := (\text{Last three digits of student ID mod } 10) + 2$  For Example, The student having the ID 190041203 should calculate the value of  $N$  as follows:

$N := (203 \text{ mod } 10) + 2$

☐  $N := 3 + 2$

☐  $N := 5$
  - c) How many different levels of addresses are used in data communications? What are the addresses and which OSI layer defines these addresses? Write down the significance or necessity of each level of address. 8  
(CO1)
  - d) Mr. X and Mr. Y are talking over **Cell Phones**. Cellular communication uses the infrastructure provided by mobile operators which includes radio resources. Identify the five components of **Data Communications** in the above system. 4.33  
(CO1)
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2. a) Distinguish between synchronous and statistical time-division multiplexing (TDM). 10.33  
(CO2)  
 Briefly explain the strategies used when the input lines of a multiplexer have different data rates?
- OR
- With necessary diagrams briefly explain the Frequency Hopping Spread Spectrum (FHSS) technique? What is the main motivation of using FHSS that outweighs its bandwidth efficiency? 10.33  
(CO2)

- b) Briefly explain the concept of a digital signal as a composite analog signal. Explain the baseband transmission of the digital signal. 4+10 (CO2)
- c) What do the Nyquist theorem and the Shannon capacity have to do with communications? 4+5 (CO2)  
We have a channel with 4 kHz bandwidth. If we want to send data at 100 Kbps, what is the minimum  $SNR_{dB}$ ? What is the SNR?
3. a) With necessary diagrams and equations, explain the Pulse Code Modulation (PCM) technique for digitization. How does PCM differ from the Delta Modulation (DM)? 11.33 (CO2)
- b) Consider the last three digits of your **student ID** as hexadecimal digits and generate 12 digits binary bit stream from the last three digits of your student ID (for example, if the last three digits of your student ID is 123 then you should consider the binary bit stream as 000100100011). Draw corresponding digital signals for the following line coding schemes and also comment on the bandwidth requirement of each of the schemes. 12 (CO2)  
i. Pseudoternary      ii. NRZ-L      iii. MLT-3      iv. Differential Manchester
- c) What do you mean by scrambling? How does scrambling differ from block coding? 5+5 (CO2)  
Consider a bit stream: 110000100000000000. Draw corresponding digital signals for the following line coding schemes.  
i. *B8ZS*      ii. *HDB3*
- OR
- Briefly explain the concept of a constellation diagram. Give the constellation diagrams for the following: 5+5 (CO2)  
i. Binary ASK      ii. BPSK      iii. QPSK      iv. 4-QAM      v. 16-QAM