**BRAC UNIVERSITY**

**Department of Computer Science and Engineering**

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| Examination: Semester Midterm  Duration: 1 hour 10 min | Semester: Summer 2023  Full Marks: 30 |
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CSE 320: Data Communications

Answer the following questions.

Figures in the right margin indicate marks.

**SET A**

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| Name: | ID: | Section: |

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| **1.**  **[CO1]** | a) | Suppose there are 4 buildings in BRACU’s new campus. Buildings are connected using bus topology. Each building has 3 CSE Labs. Each Lab has 4 computers. The computers are connected using mesh topology but the Labs of a single building are connected using star topology. **Draw** the BRACU new campus hybrid topology. How many links will there be (links are using full-duplex transmission mode)? | [5] |
| b) | **Identify** the name of the **TCP/IP model** layers based on the following functionalities.   * Enables resource sharing and remote file access among network users. * Responsible for converting data into signals for transmission over a physical medium. * Responsible for establishing and terminating communication sessions. * Ensure reliable hop to hop transmission. | [2] |
|  | c) | **Identify** at least 2 differences amongst logical, physical and port addresses. Explain with an example why all these addresses are needed? | [3] |
| **2.**  **[CO2]** | a) | **Figure 2.a: Analog Signal (time Vs Amplitude)**  In the above Figure 2.a, **determine** the time period and frequency of the analog signal. Also show the frequency domain representation of the signal if the maximum amplitude is 20V. | [3] |
|  | b) | Suppose the signal power is 5 MW at point A. The power loss rate at the wire from A to B is 5 kW/km and from C to D is 0.05 dB/km. **Calculate** the total change of signal power in decibel and comment if the power is being amplified/attenuated. | [3] |
|  | c) | Consider a communication channel that requires to send 108 GB within 6 hours. The link operates on signals with frequency range from 900 KHz to 14 MHz. If the link is perfect, i.e., no noise is introduced in the link,   * **Determine** the number of voltage levels needed to fulfill the requirement. * In practice, there is no noise free channel. Suppose, the strength of the noise power is 20mW which is 60 times weaker than the signal power. **What** will be the channel capacity considering the noise? | [2+2] |
| **3.**  **[CO2]** | a) | Two devices A and B are sending digital signals using the NRZ-I-line coding scheme. Device C is receiving the signal simultaneously and combining them using bitwise AND operation. Then produces the final digital signal using a line coding scheme that doesn’t have the consecutive 0 problem. Illustrate the final signal produced by C. [You can use any valid line coding scheme for C] [Draw it in the question paper only.] | [5] |
|  | b) | The following figure depicts a sampled analog signal for digital signal representation. By applying the concept of **Pulse Code Modulation**, assume there will be **3-bit** code words for each sampled amplitude. **Show** the **normalized Quantized** value and **quantization code** for the given analog signal value at different time stamps. Assume that the sampling amplitudes are between -40V to +40V. | [5] |

