**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 B**

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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 star topology but the Labs of a single building are connected using mesh 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.   * Determines the logical address of the destination device. * Ensures no unintended party can eavesdrop on the data being transmitted. * Prevents traffic congestion between a device and its neighbouring hop. * Ensures that data is received by the correct process among many processes running on the destination host. | [2] |
|  | c) | What characteristics does the effectiveness of data communication depend on? **Describe** how the sender and receiver use the capacity of the channel in simplex, half-duplex and full-duplex mode. | [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 15V. | [3] |
|  | b) | Suppose the signal power is 6 MW at point A. The power loss rate at the wire from A to B is 3 kW/km and from C to D is 0.04 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 8 hours. The link operates on signals with frequency range from 800 KHz to 13 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 30mW which is 20 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 OR operation. Then produces the final digital signal using a line coding scheme that doesn’t have the long sequence of 1 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 -20V to +20V. | [5] |

