

BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Semester Midterm
Duration: 1 hour 20 min

Semester: Fall 2024
Full Marks: 30

CSE 320: Data Communications

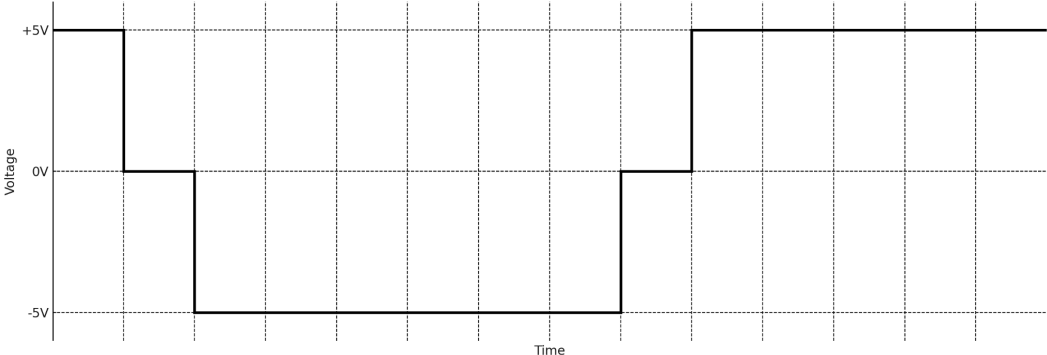
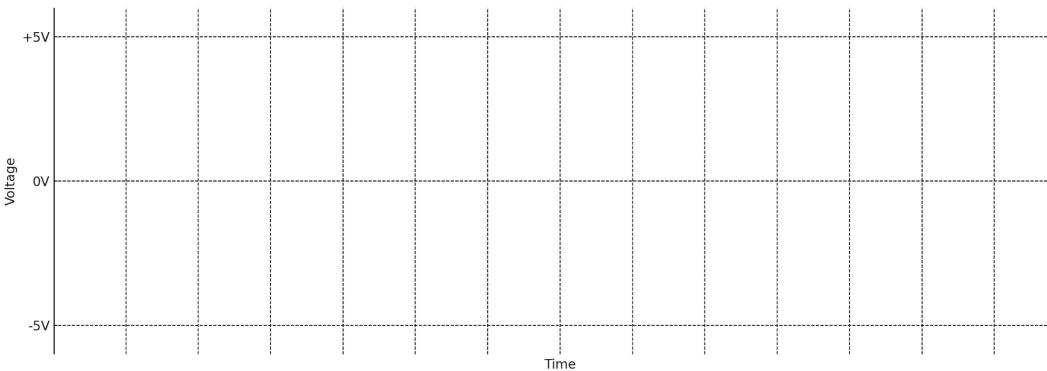
Answer the following questions [Total 3].
Figures in the right margin indicate marks.

SET A

Name:	ID:	Section:
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1. [CO1]	a)	<p>Suppose we are trying to design a network architecture for a software company. The company has 4 departments; Marketing department, Sales department, Finance department and Customer support department. Each department has 2 teams working individually. Each team consists of exactly 5 members.</p> <p>Design the network architecture that satisfies the following criteria. Calculate the total number of links.</p> <ul style="list-style-type: none">• Members of a team are connected by a central device to communicate with each other.• Teams of a department are connected to an optical fiber using multipoint connection that works as a backbone.• All departments are interconnected to provide reliable connections ensuring fast communication.	[4]
	b)	<p>Charlie is working remotely and needs to securely connect to his company's database to update client information. He begins by initiating a connection that verifies his login credentials. Once verified, the connection must remain stable to prevent any disruptions during his session. As Charlie enters his updates, the software on his computer first ensures that the data is in the correct format and is encrypted before it's sent. The data is then broken down into manageable pieces that are each checked for data integrity before and after transmission. This process also ensures that all data arrives in the exact order it was sent and checks for any duplications or data losses. Additionally, the network manages the path of the data, adapting to network traffic and connectivity changes to ensure efficient routing.</p> <p>Identify the OSI model layers involved when:</p> <ol style="list-style-type: none">1. Charlie's connection is authenticated and maintained.2. Charlie's data is formatted and encrypted.3. Data is segmented, checked for integrity, and ordered during transmission.	[3]

<div>1. [CO1]</div>	<div>c)</div> <div><p>You have been tasked to work with the network topology shown below. Assume the physical addresses to be the alphabets and the numbers represent logical addresses. Web server and File server use port number 80 and 20 respectively to send data to clients. For the Devices, use a Port number from the dynamic ports (49152 - 65535) or registered ports (1024 to 49151).</p><div><p>Port No: FTP = 20 HTTP = 80</p></div><ul style="list-style-type: none">PC4 is downloading a file (Frame 2) from File server which is using Port 20.Frame 1 is intended for PC3 which is coming from Web Server.<p>Complete the frames with the destination and source MAC, IP, and Port addresses.</p><table><tr><td rowspan="2">Frame1</td><td>D. Mac</td><td>S. Mac</td><td>D. IP</td><td>S. IP</td><td>D. Port</td><td>S. Port</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td rowspan="2">Frame2</td><td>D. Mac</td><td>S. Mac</td><td>D. IP</td><td>S. IP</td><td>D. Port</td><td>S. Port</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></div>	Frame1	D. Mac	S. Mac	D. IP	S. IP	D. Port	S. Port							Frame2	D. Mac	S. Mac	D. IP	S. IP	D. Port	S. Port							<div>[2.5 + 2.5]</div>
Frame1	D. Mac		S. Mac	D. IP	S. IP	D. Port	S. Port																					
Frame2	D. Mac	S. Mac	D. IP	S. IP	D. Port	S. Port																						
<div>2. [CO2]</div>	<div>a)</div> <div><p>Suppose, a transmission line is 10 km long. Along this line, any signal deteriorates at an average rate of 3 W/km throughout the transmission. To prevent the signal from degrading too much, a 15x (15 times) amplifier is placed at 6 km distance from source. The signal strength at source is 20W. Calculate attenuation in each part of the transmission medium and find the total attenuation.</p><p>[Hint. There are three segments in the overall transmission medium]</p></div>	<div>[4]</div>																										

<p>2. [CO2]</p>	<p>b)</p>	<p>A communication channel operates in a noisy environment where the average signal power is 1533 W and the average noise power is 3 W. The channel has a bandwidth of 1 MHz.</p> <ul style="list-style-type: none"> • Calculate the theoretical maximum capacity of the channel. • If the system operates at a bit rate that is 75% of the maximum capacity, determine the number of signal levels required to achieve this bit rate. 	<p>[2+2]</p>
	<p>c)</p>	<p>You are sending a non-periodic composite signal to your friend who lives 94 km apart through a transmission channel. The signal can be decomposed into sine waves where the highest and lowest time periods of the waves are 500 ms and 4 ms respectively. All the sine waves have a peak amplitude of 5V. The speed of the medium is 900 m/s.</p> <ul style="list-style-type: none"> • Draw the composite analog signal in the frequency domain representation. • Calculate the propagation delay of the channel. 	<p>[2+2]</p>
<p>3. [CO2]</p>	<p>a)</p>	<p>The following signal was obtained using a particular line coding scheme.</p>  <ol style="list-style-type: none"> Deduce which line coding scheme was used and decode the original bit stream. Explain whether this signal suffers from baseline wandering and DC components issue. Redraw the signal using a suitable scrambling technique that does not suffer from these drawbacks of consecutive 4 zeros. 	<p>[3+1+2]</p>