



Department of Computer Science & Engineering
University of Barishal

B.Sc. 2nd Year 2nd Semester Final Examination-2022

Course Code: CSE-2205

Course Title: Data Communication

Full Marks: 60

Time: 03 hour

There are **eight** questions. Answer any **five** of the questions. Figures in the right-hand margin indicate full marks.

- ✓ (a) What do you mean by data communication? Write shortly about the main components of a data communication system. [03]
- (b) When two or more devices connected through links, there is a term called "physical topology". So, what do you mean by this term? Write the advantages and the disadvantages of those topologies. [06]
For n devices in a network, what is the number of cable links required for each of those topologies?
- (c) What is OSI model? Differentiate between OSI and TCP/IP model. [03]
2. (a) What is composite signal? How can we decompose it into its components? Explain it briefly. [03]
- (b) What are the main causes of transmission impairments? Explain it briefly. [02]
- (c) What is the way to measure attenuation? [04]
The loss in a cable is usually defined in decibels per kilometer (dB/km). If the signal at the beginning of a cable with -0.3 dB/km has a power of 2 mW, what is the power of the signal at 10 km?
- (d) What is SNR? If the peak voltage value of a signal is 20 times the peak voltage value of the noise, what is the SNR? What is the SNR_{dB} ? [03]
3. (a) Explain the following terms with a proper example: bit stuffing, byte stuffing, pulse stuffing. [03]
- (b) How does an analog signal convert into digital signal? Briefly explain all the steps associated with it. [04]
- (c) What is QAM? Differentiate between 4-QAM and 8-QAM. Draw an 8-QAM signal of the following bit stream- [05]
000 001 111 100 101 010 001 110 011 101
- ✓ (a) What is line encoding scheme? Draw the digital signal of the following bit stream by the following schemes: unipolar NRZ, polar NRZ-I, polar RZ, polar-biphase (Manchester and differential Manchester), bipolar-AMI and pseudo-ternary and multilevel 2B1Q. [06]
0100111001
- (b) Mention your logic about which analog conversion technique is the most susceptible to noise. [02]
- (c) Briefly explain different types of analog-to-analog conversion techniques including advantages, disadvantages and real application scenarios. [04]
5. (a) Explain IP spoofing and packet sniffing? [03]
- (b) Mention some error controlling protocols for a noisy channel? Explain one of them using a suitable example with illustrations. [05]
- (c) Assume that, in a Stop-and-Wait ARQ system, the bandwidth of the line is 1 Mbps, and 1 bit takes 40 ms to make a round trip. What is the bandwidth-delay product? If the system data frames are 1000 bits in length, what is the utilization percentage of the link? [04]
6. (a) Why do we need to apply multiplexing technique in data communication? Mention three multiplexing techniques and differentiate them. [05]
- (b) Five channels, each with a 100-kHz bandwidth, are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 10 kHz between the channels to prevent interference? [02]

- (c) How to efficiently use TDM to remove the wastage of the bandwidth when one or more slots of TDM on the output link will go unused. [03]
- (d) What are the three strategies that can be used to overcome the data rate mismatch in all input links during multiplexing. [02]
7. The university administration wants to enhance communication and data sharing among various departments: the Admission Office, Registrar's Office, Library, Finance Department, enrollments, and fee payments, can be shared reliably and in real time across these departments. Additionally, the university plans to offer online classes, which require reliable video and audio streaming services.
- (a) In this university setting, explain how data communication networks can be structured to ensure efficient information sharing between the Admission Office, Registrar's Office, Library, and other departments. Describe whether you would use circuit switching or packet switching for general departmental communication and explain your reasoning. [04]
- (b) The university plans to offer online courses requiring real-time audio and video streaming. Explain the concept of virtual circuit networks and analyze how it could be beneficial for handling live online classes. Mention any challenges that may arise if the virtual circuit network is congested and how this could impact class quality. [04]
- (c) To manage communication between departments efficiently, the university is considering implementing multiplexing techniques. Using a suitable diagram, explain how Frequency Division Multiplexing (FDM) or Time Division Multiplexing (TDM) could be applied to optimize data flow between various departments. Specify which technique would be more effective for transferring large files (e.g., library records) versus real-time voice or video data, and justify your choice. [04]
8. You work as a network engineer for a company that has offices in two different cities. The company wants to set up a secure and efficient data communication system between the two offices. They plan to transfer sensitive files and video conferencing data between these locations. Currently, they face challenges with slow data transfer speeds, occasional data loss, and a lack of security. Your task is to design a data communication solution that meets the following requirements:
1. Since the company handles real-time data, the solution should minimize delay during file transfers and video calls.
 2. The system should ensure data is transferred accurately, without losses or corruption, even in the event of network interruptions.
 3. As the data is sensitive, a secure method for data transmission should be implemented to prevent unauthorized access.
 4. The company has a limited budget, so your solution should balance cost and performance.
- (a) Which data communication protocols would you recommend for this setup to ensure both reliability and security? Explain why you chose these protocols. [04]
- (b) Which transmission medium (e.g., fiber optics, copper cables, wireless) would be best suited for this inter-city data communication? Justify your choice considering speed, reliability, and cost. [04]
- (c) Propose a network topology that would be suitable for this setup and discuss one security measure you would implement to protect data during transmission between the offices. [04]

Good Luck!!!