



Daffodil International University
Faculty of Science & Information Technology
Department of Software Engineering
Midterm Examination, Spring 2026
Course Code: SE-225

Course Title: Data Communication and Computer Networking

Sections & Teachers: (A-J) KBB, RT, AMR, MH, HBM

Time: 1 Hour 30 Mins

Marks: 25

Answer ALL Question

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	A national defense agency is designing a communication network for 6 critical command centers scattered across rugged terrain. The primary requirement is maximum fault tolerance; the network must sustain communication even if multiple links or nodes fail simultaneously during a crisis. Cost and cabling complexity are secondary concerns, but latency should be minimized.		
a)	Investigate the scenario to identify the most suitable network topology for this setup & justify your choice by explaining how this topology meets the agency's needs.	[Marks-2]	CLO-1 Level-4
b)	If the agency decides to add 20 more minor outposts to this network with a limited budget, apply your knowledge to modify the topology to balance the new cost constraints while maintaining high reliability for the original 6 centers.	[Marks-3]	
	"NebulaCloud", a data storage provider, has deployed a dedicated high-speed fiber optic backbone connecting their primary Data Center to a Regional Edge Node located 240 kilometers away. • Signal Physics: The laser transmitter at the Data Center injects a signal with a power of 8.0 mW. However, due to scattering and absorption in the glass, the signal power drops to 2.5 mW by the time it reaches the Edge Node. • Medium Properties: The fiber optic cable has a core refractive index that allows light to travel at a speed of $2.8 \times 10^8 \text{ ms}^{-1}$. • Traffic Data: During a scheduled backup, a 15 MB database snapshot is transmitted from the Data Center to the Edge Node. The network interface requires 0.5 seconds to fully push this entire file onto the link (Transmission Time).		

	Network Overhead: Due to router congestion, the frame experiences an average queuing delay of 5 milliseconds and a processing delay of 1.5 milliseconds at the receiver side.		
c)	Calculate the attenuation per kilometer (in dB/km) of the fiber link	[Marks-2]	
d)	Compute the total latency (in seconds) for transmitting that frame	[Marks-3]	
2.	A multinational bank has two major operational departments: - Department A (Trading Floor): Located in London, UK. This is a high-density environment with 200 workstations packed closely together. The room is filled with electronic equipment (multiple monitors per desk, servers, tickers), creating a noisy electromagnetic environment. - Department B (Data Analysis): Located in New York, USA. It contains 150 workstations in a standard office park. The bank requires a seamless network connecting these internal departments and a backbone linking the two countries.		CLO- 2 Level-2
a)	As the network engineer, discuss which type of guided transmission medium should be used for each of the departments mentioned in the scenario.	[Marks-6]	
b)	The London branch needs a high-speed backup link to a Disaster Recovery Center located on another skyscraper 5 km away. Laying a physical cable through the busy city streets is impossible. Explain which transmission media helps to meet this requirement & discuss advantages and disadvantages of this medium compared to wired methods.	[Marks-4]	
3.	A data link layer uses a bit-oriented framing protocol. A frame consists of a header, a payload, and a trailer. The protocol uses the bit pattern 01111110 (six consecutive 1s) as a flag to indicate the start and end of a frame. Consider a payload consisting of the following bit sequence: 00111111011111001		CLO- 3 Level-3
a)	Determine the specific framing mechanism required to ensure the receiver can correctly distinguish the data from the frame delimiters & identify the final transmitted bit pattern of the following bit stream.	[Marks-2]	
b)	If a Fixed-Sized Framing method were used instead (e.g., every frame is exactly 40 bits), and the payload was only 23 bits, determine how many bits of padding would be required?	[Marks-1]	
c)	When a frame 1011001 is sent across the link, it is received as 1110011 at the destination. Capture the type of error that occurred and identify an appropriate error correction method that can be used to detect and correct this error.	[Marks-2]	