Q.No	Solution / Key Points	Marking Scheme
Q.1	**Attempt any FOUR**	**5 Marks Each**
A	**DLL Design Issues & Services:** • **Services:** Unacknowledged connectionless, Acknowledged connectionless, Acknowledged connection-oriented.• **Issues:** Framing (character/bit stuffing), Error Control (ARQ), Flow Control (Stop-and-wait).	• Services: 2M• Design Issues: 3M
B	**IPv6 Need & Improvements:• Need:** 32-bit IPv4 address exhaustion (~4.3 billion addresses).• **Improvements:** 128-bit address space, simplified header (faster routing), no checksum at IP layer, mandatory IPsec.	• Need: 1M• Improvements: 2M • Advantages: 2M
C	**Berkeley Sockets & Primitives:• Concept:** Endpoint for communication (IP + Port).• **Primitives:** SOCKET (init), BIND (assign addr), LISTEN (wait), ACCEPT (connect req), CONNECT (initiate), SEND/RECEIVE.	• Concept: 2M • Primitives: 3M
D	**Checksum Calculation (Data 11001010, 4-bit):• (i) Calc:** 1100 + 1010 = 10110. Wrap carry: \0110 + 1 = 0111$. Checksum = **1000** (1's complement).• **(ii) Detection:** Receiver adds blocks + checksum. If result is all 1s (0 after complement), no error.	(i) Step: 3M (ii) Logic: 2M
E	**Fiber vs. Twisted Pair:• Fiber:** Light pulses, highest bandwidth, immunity to EMI, costly. App: Backbone/ISP.• **Twisted Pair:** Electrical signals, lower bandwidth, copper-based, easy to install. App: LAN cabling.	• Principle: 2M • Comparison: 2M • App: 1M
F	**TCP/IP vs. OSI:• Layers:** App, Transport, Internet, Network Access.• **Diff:** OSI is 7-layer (theoretical), TCP/IP is 4-layer (functional). OSI has Session/Presentation layers; TCP/IP merges them.	• Layers: 3M • OSI Diff: 2M
Q.2	**Attempt any FOUR**	**10 Marks Each**
A	**Multiple Access Protocols:• Pure Aloha:** Send immediately; total vulnerability.• **Slotted Aloha:** Send only at start of slots; doubles efficiency.• **CSMA:** Carrier sensing - "Listen before talk." • **CSMA/CD:** Detects collisions and stops transmission immediately.	• 2.5M each(Diag + Desc)

Q.No	Solution / Key Points	Marking Scheme
B	**DLL Protocols:**• **Noiseless:** Simplex, Stop-and-Wait (ideal channel).• **Noisy:** Stop-and-Wait ARQ (uses timers and sequence numbers to handle packet loss).	• Noiseless: 5M • Noisy: 5M
C	**Routing Algorithms:**• **Distance Vector (RIP):** Uses Bellman-Ford; nodes share vectors with neighbors.• **Link State (OSPF):** Uses Dijkstra; nodes have full map of the network.	• List: 2M • Detail (2): 8M
D	**CRC Trailer & Calculation:**• **Trailer:** Logical since CRC is calculated as data flows; check occurs at the end without buffering.• **Calculation:** Binary division of 11010110110000(appended 0s) by 10011gives the remainder (CRC).	• Trailer: 3M • Calc: 7M
E	**Topology:** Layout of the network (Mesh, Star, Bus, Ring, Hybrid). Star is the most common using a central Hub/Switch.	• Def: 1M • Types: 9M
F	**Go-Back-N Protocol:** Sliding window protocol where sender can send Nframes. On error, it re-transmits all un-ACKed frames from the point of failure.	• Logic: 10M
Q.3	**Attempt any FOUR**	**5 Marks Each**
A	**Need of Layering:** Modularity, simplified design, interoperability between different hardware/software vendors.	• Points: 5M
B	**Piggybacking:** Attaching an ACK to an outgoing data frame to save bandwidth instead of sending a separate ACK packet.	• Expl: 3M • Adv: 2M
C	**Subnetting:** Dividing a large network into smaller segments. Default masks: A (255.0.0.0), B (255.255.0.0), C (255.255.255.0).	• Expl: 3M • Masks: 2M
D	**TCP vs. UDP:** TCP is reliable, connection-oriented, and slow; UDP is connectionless, fast, and unreliable (best for streaming).	• 5 points: 5M
E	**DNS:** Translates domains (google.com) to IPs. Uses a hierarchy of Root, TLD, and Authoritative servers.	• Need: 2M• Proc: 3M
F	**EM Spectrum:** Frequency range of EM radiation. Apps: Radio (Broadcasting), Microwave (Satellite/WiFi), Infrared (Remote).	• Spec: 2M • Apps: 3M