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Mid Term Examinations - October 2026

Date: 05/10/2026 **Time:** 11:45 AM - 01:15 PM

Course Code: ECE3053 **Course Name:** Data Communication and Networking

Semester: Seventh Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2	CO3
Marks	44	26	20

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	**Components of a Data Communication System – 2 Marks** · Sender: device that generates and sends the data · Receiver: device that receives the data · Message: information/data being transmitted · Transmission medium/channel: · Protocol: rules governing communication	2	CO1	BT2
2	**Propagation Time and Transmission Time – 2 Marks** · Given: Message size = 2.56 kB = 2.56 × 1024 × 8 = 20,971.52 bits; bandwidth = 1 Gbps; distance = 12,000 km = 12 × 10^6 m; propagation speed = 2.4 × 10^8 m/s. · Transmission time = Message size / Data rate = 20,971.52 / 10^9 = 2.097 × 10^{-5} s ≈ 20.97 μs – 1 mark · Propagation time = Distance / Propagation speed = (12 × 10^6)/(2.4 × 10^8) = 0.05 s = 50 ms – 1 mark	2	CO1	BT2
3	**Bit Stuffing – 2 Marks** · Original data: 01111110. The sequence contains five consecutive 1s after the initial 0. · Insert a 0 after every sequence of five consecutive 1s: 011111010 – 1 mark · At the receiver, remove the inserted 0 following five consecutive 1s, recovering 01111110 – 1 mark · The flag 01111110 is reserved for frame delimiting; the stuffed data prevents the data from being mistaken for a flag.	2	CO2	BT3
4	**Even-Parity Bits – 2 Marks** · For even parity, the total number of 1s including the parity bit must be even. · a) 1001011 has four 1s → parity bit = 0 – 0.5 mark · b) 0001100 has two 1s → parity bit = 0 – 0.5 mark · c) 1000000 has one 1 → parity bit = 1 – 0.5 mark · d) 1110111 has six 1s → parity bit = 0 – 0.5 mark	2	CO2	BT2

ANSWER KEY

PTO (Please Turn Over)

5	**Hamming Distance – 2 Marks** · Hamming distance is the number of bit positions in which two equal-length codewords differ. d(10000,00000)=1 ; d(10101, 10000): =2	2	CO2	BT2

PART B : Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
6	**6(a). OSI Model, Layers, Protocols and Communication Diagram – 10 Marks** · Purpose and organization of OSI model: seven layers, modular design, standardization, encapsulation and decapsulation – 2 marks · Layer-wise functions: Physical (bits/signals), Data Link (framing/MAC/error detection), Network (logical addressing/routing), Transport (end-to-end delivery/reliability/flow control), Session (dialogue management), Presentation (translation, encryption, compression), Application (network services to users) – 3 marks · Suitable protocols/examples: Ethernet/PPP, IP, TCP/UDP, HTTP/HTTPS, DNS, SMTP, FTP, etc., mapped appropriately to layers – 2 marks · Communication explanation: User A data is encapsulated from Application to Physical layer, transmitted through the network, and decapsulated from Physical to Application at User B – 1.5 marks · Neat and correctly labelled diagram showing User A, Network A, intermediate network, Network B, User B and encapsulation/decapsulation – 1.5 marks	10	CO1	BT2
7	**Network Topologies – 10 Marks** · Bus: shared backbone; advantage—low cost/easy installation; disadvantage—backbone failure affects network and collisions; application—small/legacy LANs – 2 marks · Star: all nodes connected to a central switch/hub; advantage—easy management and fault isolation; disadvantage—central-device failure affects network and more cabling; application—modern Ethernet LANs – 2 marks · Ring: nodes form a closed loop; advantage—orderly access/predictable transmission; disadvantage—break/failure can disrupt network unless dual ring/bypass is used; application—legacy token-ring/fibre networks – 2 marks · Mesh: nodes have many/all interconnections; advantage—high redundancy and reliability; disadvantage—expensive and complex; application—WAN backbones, wireless mesh, critical networks – 2 marks · Hybrid: combination of two or more topologies; advantage—flexible and scalable; disadvantage—design and maintenance complexity/cost; application—large enterprise/campus networks – 2 marks	10	CO1	BT2

PART C: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**

ANSWER KEY

8	**(i). Transmission, Propagation and Total Latency – 5 Marks** · Given: L = 10,000 bits, R = 20 Mbps, distance = 2000 km = 2×10^6 m, propagation speed = 2×10^8 m/s. · Transmission delay = L/R = 10,000/(20×10^6) = 0.0005 s = 0.5 ms – 2 marks · Propagation delay = distance/speed = (2×10^6)/(2×10^8) = 0.01 s = 10 ms – 2 marks · Total latency = transmission delay + propagation delay = 0.5 + 10 = 10.5 ms – 1 mark **(ii). Transmission Modes – 5 Marks** · System A: Keyboard to computer → Simplex. Data flows in one direction – 1 mark · System B: Two-way radio → Half-duplex. Both sides can transmit, but not simultaneously – 1 mark · System C: Telephone call → Full-duplex. Both sides can transmit and receive simultaneously – 1 mark · Explanation of data flow and appropriate examples – 1 mark · Diagrams: Simplex A → B; Half-duplex A ⇄ B with one direction at a time; Full-duplex A ⇄ B with simultaneous directions – 1 mark	10	CO1	BT2
9	**TCP/IP Model and Layer Functionalities – 10 Marks** · Identification of TCP/IP layers and overall purpose – 1 mark · Application layer: provides services such as HTTP, FTP, SMTP, DNS and user-level network applications – 2 marks · Transport layer: process-to-process delivery, segmentation/reassembly, port addressing, reliability using TCP and connectionless delivery using UDP, flow/congestion control – 2 marks · Internet layer: logical addressing and routing using IP; packet forwarding and related control functions such as ICMP – 2 marks · Network Access/Link layer: framing, MAC addressing, error detection and transmission over the physical medium; Ethernet/Wi-Fi examples – 2 marks · Clear diagram and explanation of encapsulation/decapsulation during transmission – 1 mark	10	CO1	BT2

PART D: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
10	**CRC Calculation and Error Detection – 10 Marks** · Generator polynomial $G(x) = x^3 + x + 1$ → generator bits = 1011; append three zeros to data 1101011011 to obtain 1101011011000 – 2 marks · Modulo-2 division of 1101011011000 by 1011 gives remainder 100 – 4 marks · Transmitted codeword = original data + remainder = 1101011011 100 = 1101011011100 – 2 marks · If the second bit is inverted, received sequence becomes 1001011011100. The receiver divides it by 1011; a non-zero remainder is obtained, indicating an error – 2 marks · Accept a correctly shown modulo-2 division with equivalent notation.	10	CO2	BT3

ANSWER KEY

11	**Stop-and-Wait Protocol – 10 Marks** · Basic operation: sender transmits one frame, starts timer, waits for ACK; receiver checks frame and sends ACK; sender proceeds after ACK – 2 marks · Normal transmission: Data frame → receiver → ACK → sender stops timer and sends next frame – 2 marks · Data-frame loss: frame is lost; receiver sends no ACK; sender timer expires and retransmits the frame – 2 marks · ACK loss: receiver receives frame and sends ACK, but ACK is lost; sender timer expires and retransmits; sequence numbers help receiver discard duplicate data and send ACK again – 2 marks · Suitable timing/flow diagrams showing frame, ACK, timer expiry and retransmission for all three cases – 2 marks	10	CO2	BT3

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	**Definition and purpose of channelization: dividing a shared medium among multiple users to enable simultaneous access with user separation – 1 mark ·** **FDMA: users are assigned separate frequency bands and transmit simultaneously; guard bands may be used – 2 marks ·** **TDMA: users share the same frequency but transmit in different time slots; synchronization is required – 2 marks ·** **CDMA: users share the same frequency and time but use distinct spreading codes; receiver separates users using code correlation – 2 marks ·** **Comparison based on resource allocation: frequency, time, and code respectively – 1 mark ·** **Neat diagrams showing frequency bands for FDMA, time slots for TDMA, and distinct codes/users for CDMA – 2 marks**	10	CO3	BT3
13	· CSMA principle: a station senses the shared channel before transmission; if idle, it transmits; if busy, it defers according to the CSMA variant – 3 marks · Collision handling: collisions may still occur due to propagation delay; station detects/handles collision where applicable, waits using a backoff algorithm, and retransmits – 2 marks · CSMA operation/flow: sense → idle/busy decision → transmit or defer → collision/ACK check → backoff and retransmission if required – 2 marks · Comparison with ALOHA: ALOHA transmits without sensing and therefore has a higher collision probability; CSMA senses before transmission and generally reduces collisions; both use retransmission after collision or timeout – 2 marks · Neat flow diagram or suitable example – 1 mark	10	CO3	BT3

ANSWER KEY