KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.Tech.
Year : III

Course : AICS 301
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 12 Dec.

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices.

1. A network that covers a city or a campus is called a
   a. Personal Area Network (PAN)
   b. Local Area Network (LAN)
   c. Metropolitan Area Network (MAN)
   d. Wide Area Network (WAN)

2. Which layer of the OSI model ensures the error-free transmission of data?
   a. Physical
   b. Data Link
   c. Network
   d. Transport

3. Which transmission media is immune to electromagnetic interference (EMI)?
   a. Twisted-pair cable
   b. Coaxial cable
   c. Fiber-optic cable
   d. Wireless media

4. A technique that spreads the signal over a wider bandwidth to make it difficult for attackers to intercept and decode is called
   a. Frequency Hopping Spread Spectrum (FHSS)
   b. Code Division Multiple Access (CDMA)
   c. Time Division Multiple Access (TDMA)
   d. None of the above

5. Which sublayer of the Data Link Layer provides services to the Network Layer?
   a. Physical Layer
   b. Logical Link Control (LLC)
   c. Media Access Control (MAC)
   d. None of the above

6. Which flow control mechanism is most efficient in terms of bandwidth utilization, especially in high-latency networks?
   a. Stop-and-Wait ARQ
   b. Go-Back-N ARQ
   c. Selective Repeat ARQ
   d. Sliding Window Protocol

7. Which error detection technique involves adding extra bits to a data word to create a codeword?
   a. Parity Check
   b. Cyclic Redundancy Check (CRC)
   c. Hamming Code
   d. All of the above

8. Which MAC protocol is suitable for wireless networks where collision detection is difficult?
   a. ALOHA
   b. CSMA/CD
   c. CSMA/CA
   d. TDMA

9. In Classful Addressing, the first few bits of an IP address determine its
   a. Network Address
   b. Host Address
   c. Class
   d. None of the above

10. Which of the following is a unique feature of IPv6 that allows sending a packet to a group of devices?
   a. Anycast address
   b. Broadcast address
   c. Multicast address
   d. Unicast address

11. Which routing algorithm calculates the shortest path to each network destination and updates the routing table accordingly?
   a. Distance Vector Routing
   b. Link-State Routing
   c. Hierarchical Routing
   d. Hybrid Routing

12. Which of the following techniques is used to prevent network congestion?
   a. Flow control
   b. Congestion control
   c. Both A and B
   d. None of the above

13. Which protocol is often used for applications that require low latency and high throughput?
   a. TCP
   b. UDP
   c. Both TCP and UDP
   d. Neither TCP nor UDP

14. Which layer of the OSI model does SSL/TLS operate on?
   a. Physical Layer b. Data Link Layer c. Network Layer d. Transport Layer

15. Which email protocol allows users to retrieve and store emails on the mail server?
   a. IMAP b. POP3 c. SMTP d. HTTP

16. Which API style allows clients to specify exactly the data they need, minimizing unnecessary data transfer?
   a. REST b. GraphQL c. gRPC d. MQTT

17. What is the block size of the Data Encryption Standard (DES)?
   a. 64 bits b. 128 bits c. 256 bits d. 512 bits

18. Which cryptographic algorithm is commonly used to create digital signatures?
   a. RSA b. AES c. DES d. SHA-256

19. What is the output size of the MD5 hash function?
   a. 64 bits b. 128 bits c. 160 bits d. 256 bits

20. Which type of IDS analyzes network traffic to detect anomalies and potential attacks?
   a. Network-based IDS (NIDS)
   b. Host-based IDS (HIDS)
   c. Both A and B
   d. None of the above

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SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions. **(Q.N. 4 is compulsory)**

1. Differentiate between protocols and standards. Explain the TCP/IP model, including the protocols used in its various layers.

2. Differentiate Unshielded Twisted Pair (UTP) and Shielded Twisted Pair (STP) cables. What are the advantages of using fiber optic cables over UTP cables in networking?

3. What is the purpose of flow control in data communication? Compare Stop and Wait ARQ, Go-Back-N ARQ, and Selective Repeat ARQ in tabular form.

4. What is sub-netting? Given the IPv4 address 192.168.1.0/24, calculate the following:
   a. Total number of subnets if the subnet mask is changed to /26.
   b. Number of valid hosts per subnet.
   c. First and last valid IP addresses of the first subnet.

5. How do firewalls use port numbers to control network traffic? Explain the difference between a TCP socket and a UDP socket.

6. Discuss the client-server architecture of FTP. How does SFTP differ from FTP in terms of security and functionality?

7. Explain the Diffie-Hellman key exchange protocol. How does it enable two parties to establish a shared secret key over an insecure channel?

SECTION "C"
[2Q × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. What is CSMA/CA, and how does it differ from CSMA/CD? Describe the CSMA/CD protocol. How does it handle collisions and improve efficiency compared to ALOHA?

9. What is a hash function? Compare and contrast MD5 and SHA-256 hash functions. Discuss their strengths, weaknesses, and use cases.

10. Write short note on (***ANY FOUR***): [4Q × 2=8]
    a. CIA triad
    b. CRC
    c. MQTT
    d. Penetration Testing Technique
    e. Security Policy and audits