Module 1

1. Illustrate and analyze the five essential components of a data communication system, and explain their role in ensuring effective communication with suitable examples.
2. Demonstrate the different ways of representing data in computers and justify with suitable examples how each method is applied in real-time computing scenarios.
3. Examine the OSI reference model in detail, and demonstrate how the layered architecture supports reliable communication by explaining the role of each layer.
4. Analyze the process of encapsulation with the help of a neat diagram, and discuss how it enables communication across layers in a networked system.
5. Differentiate and analyze the characteristics of simplex, half-duplex, and full-duplex data flow, and illustrate with real-world examples where each is applied.
6. Compare and justify the differences between LAN, MAN, and WAN by citing one practical example for each type of network.
7. Examine peer-to-peer processes in the context of the OSI model, and demonstrate how communication is coordinated across layers.
8. Differentiate and evaluate the OSI model and the TCP/IP protocol suite, highlighting their similarities, differences, and practical applicability in networking.
9. Illustrate and analyze different physical network topologies, and explain the working of any two with neat diagrams and practical examples.
10. Define protocol and standard, and critically analyze how they are interrelated in networking with suitable examples.
11. Examine the seven layers of the OSI model, and demonstrate their role in achieving reliable communication through a short explanatory note.
12. Explain and differentiate the four types of addressing in networking with examples, and analyze how each is applied in real communication scenarios.

VTU Question Papers Questions:

1. What is data communication? What are its characteristics? Explain.
2. List and explain the five components of a data communication system, with examples.
3. What is a protocol? Briefly explain its key elements.
4. Define Internet.
5. Describe with neat diagram the functions of each layer in the OSI reference model and differentiate it with TCP/IP.
6. What is a physical topology? Describe the four basic topologies with application of each.
7. What are standards? Name any four standard organizations (6 Marks, July 2009)
8. Give the comparison between LAN, MAN and WAN with an example.
9. Describe with neat diagram, the functionalities of each layer in the TCP/IP model.
10. Assume that fifty devices are arranged in a mesh topology. How many links are needed?
11. How many ports are needed for each device? (6 Marks, July 2011)
12. What are different modes of communication? (4 Marks, Jan 2013)
13. Write a short note on
    i. Addressing
    ii. Multiplexing and Demultiplexing
    iii. Encapsulation and Decapsulation of data
14. Compare OSI model with TCP/IP

Module 2

1. Differentiate between single-bit error and burst error by applying suitable examples, and analyze their impact on data communication reliability.
2. Apply the checksum technique step-by-step to demonstrate how errors are detected in a data frame, and analyze the effectiveness of this method.
3. Illustrate the concept of bit stuffing with an example, and analyze how this technique ensures proper frame synchronization in data transmission.
4. Examine the principle of FDMA with the help of a neat diagram, and evaluate how this technique allows multiple users to share the communication channel effectively.
5. Differentiate between error detection and error correction techniques, and analyze their significance in ensuring reliable data communication.
6. What is checksum, explain steps under taken by sender and receiver to detect errors
7. Write a note on error detection method using 16 bit checksum used in internet. Calculate checksum for the text "Food" given ASCII values of F is 46, o is 6F and d is 64
8. What is hamming distance? Find hamming distance for code words 00000,01011,10101,11110
9. Apply the concept of simple parity check code to demonstrate how error detection works, and discuss its limitations with respect to burst errors.
10. Compute and illustrate the codeword c(x) using CRC for the information sequence 1001 with generator 1011, and analyze the steps involved in the process.
11. Examine the principle of TDMA, and evaluate its main problem in the context of channel utilization.
12. Apply the concept of Hamming code and illustrate how syndrome bits are used to detect and correct errors in data transmission.
13. Given the dataword 101001111 and divisor 10111, compute and demonstrate the CRC codeword generation at the sender's site, explaining the steps clearly.
14. Illustrate the concept of byte stuffing with a suitable example, and analyze its role in maintaining data transparency during transmission.
15. Examine the principle of CDMA with neat diagrams, and evaluate its effectiveness in supporting multiple simultaneous users.
16. Find the code word C(X) for the information $d(X)=x^3+1$ with generator polynomial $t(X)=x^3+x+1$
17. What is hamming code? With a structure of encoder and decoder for hamming code C (7,4) how it can detect the errors and correct the same.

Module 3

1. Explain the IPv4 address space and notation.
2. Explain IPv4 classful addressing.
3. Find the class of each address and convert the following IPv4 addresses **from dotted-decimal notation to binary notation and vice versa**:
   a. 00000001 00001011 00001011 11101111
   b. 11000001 10000011 00011011 11111111
   c. 14.23.120.8
   d. 252.5.15.111
4. Explain the concepts of subnetting and supernetting.
5. A router receives a packet with destination address **190.240.33.91**. Show how it determines the network and subnetwork address to route the packet. Assume the subnet mask is **/19**.
6. A block of addresses is assigned to a small organization. One of the addresses is **205.16.37.39/28**. Find the **first address**, **last address**, and the **number of addresses** in the block.
7. Explain the IPv6 structure and address space.
8. Explain the IPv4 datagram format with a neat diagram.
9. Explain the IPv6 datagram format with a neat diagram.

10. Explain the transition from IPv4 to IPv6.
11. Explain the operation of **ARP** for mapping logical addresses to physical addresses.
12. Explain the operation of the **Bootstrap Protocol (BOOTP)** for mapping physical addresses to logical addresses.
13. Explain the operation of **RARP** for mapping physical addresses to logical addresses.
14. Explain the operation of the **Dynamic Host Configuration Protocol (DHCP)** for mapping physical addresses to logical addresses.

Module 4

1. Explain the UDP datagram format and its operation.
2. Explain TCP services with neat diagrams.
3. Explain the important features and characteristics of TCP.
4. Explain the TCP segment format with a neat diagram.
5. Explain **connection establishment**, **data transfer**, and **connection termination** in TCP.
6. Explain the services provided by the Stream Control Transmission Protocol (SCTP).
7. Explain the important features and characteristics of the Stream Control Transmission Protocol (SCTP).
8. Compare the TCP segment and the SCTP packet with neat diagrams.
9. Explain open-loop congestion control techniques.
10. Explain closed-loop congestion control techniques.
11. Explain flow characteristics and flow classes.
12. Explain scheduling techniques used to improve the quality of service in a network.
13. Explain traffic shaping techniques used to improve the quality of service in a network.

Module 5

1. Explain, with a neat diagram, the Domain Name System (DNS) used in the Internet.
2. Explain DNS message formats and headers.
3. Explain recursive and iterative DNS name–address resolution methods.
4. Explain, with a neat diagram, local and remote log-in.
5. Explain, with a neat diagram, the concept of **Network Virtual Terminal (NVT)**.
6. Explain, with a neat diagram, the first and second scenarios in electronic mail.
7. Explain, with a neat diagram, the third and fourth scenarios in electronic mail.
8. Explain the services provided by a user agent.
9. Explain the three important mail transfer phases in electronic mail.
10. Explain the **POP3** and **IMAP4** message access protocols with neat diagrams.
11. Explain the **MIME** header format with a neat diagram.