*Q1/*Answer **ONE** of the following **(10 marks)**

A- Explain the TCP/IP model.

B- List all steps need for networks to encapsulate data

1- **Build the data (application layer):** As a user sends an e-mail message, its alphanumeric characters are converted to data that can travel across the internetwork.

2- **Package the data for end-to-end transport (transport layer):** The data is packaged for internetwork transport. By using segments, the transport function ensures that the message hosts at both ends of the e-mail system can reliably communicate.

3- **Append (add) the network address to the header (network layer):** The data is put into a packet or datagram that contains a network header with source and destination logical addresses. These addresses help network devices send the packets across the network along a chosen path.

4- **Append (add) the local address to the data link header (data link layer):** Each network device must put the packet into a frame. The frame allows connection to the next directly-connected network device on the link. Each device in the chosen network path requires framing in order for it to connect to the next device.

5- **Convert to bits for transmission (physical layer):** The frame must be converted into a pattern of 1s and 0s (bits) for transmission on the medium (usually a wire). A clocking function enables the devices to distinguish these bits as they travel across the medium. The medium on the physical internetwork can vary along the path used. For example, the e-mail message can originate on a LAN, cross a campus backbone, and go out a WAN link until it reaches its destination on another remote LAN. Headers and trailers are added as data moves down though the layers of the OSI model.

Q2/Consider a LAN with a maximum distance of 2 km. At what bandwidth would propagation delay (at a speed of $2\ x\ 10^8\ m/s$) equal transmit delay (insertion delay) for 512 byte packets? What about 2000 byte packets? **(8 marks)**

Case (a): Packet Size = 512 bytes

Maximum Distance = 2 km

Speed of Light = 2×10^8 m/s

Propagation = Distance / Speed of Light

= 2000 m / 2×10^8 m/s

Transmit = Size / Bandwidth

= 512 x 8 bits / Bandwidth

Therefore,

Bandwidth = Size x Speed of Light / Distance

= (512 x 8) bits x 2×10^8 m/s / 2000 m

= 4096×10^5 bits / sec

= 409.6 Mbits/sec

Case (b): Packet Size = 2000 bytes

Maximum Distance = 2 km

Speed of Light = 2×10^8 m/s

Propagation = Distance / Speed of Light

= 2000 m / 2×10^8 m/s

Transmit = Size / Bandwidth

= 2000 x 8 bits / Bandwidth

Therefore,

Bandwidth = Size x Speed of Light / Distance

= (2000 x 8) bits x 2×10^8 m/s / 2000 m

= 16000×10^5 bits / sec

= 1600 Mbits/sec

*Q3/ Answer **SEVEN** of following* **(14 marks)**

1. Consider the network node with IP address 185.121.9.12, decipher an IP address

   The network address is 185.121.0.0 Host ID is 9.12

2. You have a network ID of 172.16.0.0 and you need to divide it into multiple subnets. You need 600 host IDs for each subnet. Which subnet mask should you assign that will allow for growth?

   255.255.252.0

3. Given the IP address 126.110.16.7 what class of address is it?

   A

4. If you have an IP address of 172.16.13.5 with a 255.255.255.128 subnet mask. What is your class of address, subnet address, and broadcast address?

   Class B, Subnet 13, Broadcast address 172.16.13.127. Valid range for hosts is 172.16.13.1 - 172.16.13.126

5. If you have a 22-bit subnet mask, how many subnets and how many hosts do you have?

   4,194,304 subnets w/ 1022 hosts

6. What are the differences between IPv4 and IPv6?
7. Give the Net & Mask of the following range (172.16.128.0 - 172.16.159.255)

   255.255.224.0

8. What is the burst error?

Q4/ (10 marks)

1. What is the VRC value for (1110111 1101111 1110010 1101100 1100100) message?
   1110111**0** 1101111**0** 1110010**0** 1101100**0** 1100100**1**

2. Compute the CRC-4 character for the following message using a “divisor” constant of 10011:

   1100 0110 1011 01

   1001

3. What is the checksum value for (01001000 01100101 01101100 01110000 00100001) message?
   10101011 ➔ 01010100

4. Suppose we want to transmit the message 1011001001001011 and protect it from errors using the CRC8 polynomial x8 +x2 +x1 +1. Use polynomial long division to determine the message that should be transmitted.
   1001 0011 MESSAGE 1011 0010 0100 0011 1001 0011

5. Compute the CRC code given the message 1101010011 and the pattern 10011. Verify that the code is correct.
   0101

Q5/ (8 marks)

A- Show the bit pattern transmitted for the message1100101 1010010 0010111 using a Hamming code

11000101100 10100011011 00110110101

B- A Hamming code whose value is (10110011110 11001111111 1111111111110) arrives at a receiver. What was the original value that sent?

1110011 1101110 1111111

Q6/ Draw a network with the following specifications: (10 marks)

(a) Two ring networks with four hosts (class A).
(b) Two bus networks with four hosts (class C).
(c) The 1st ring is connected to 1st bus by a router and to the 2nd bus by a gateway.
(d) The 2nd ring is connected to 1st bus by a gateway and to the 2nd bus by a router.
(e) The 1st ring is connected to 2nd ring by a gateway. Show all the hosts (computers), with their addresses and connections. The address selection is up to you.