ASSIGNMENT-1

1) What are two reasons for using layered protocols what is one possible disadvantage of using layered protocols?

Ans Two reasons for using Layered protocols are as follows-

1) Layering of protocols provides well-defined interfaces between the layers, so that a change in one Layer does not affect an adjacent Layer.

2) The protocols of a network are extremely complicated and designing them in layers makes their implementation more feasible.

Disadvantage:

- Scalability is difficult because the structure of the framework does not allow for growth.
- They can be difficult to maintain....
- Parallel processing is not possible.

Q2) Given a set of protocols and protocol layers in column 1 and column 2. Find the Correct match.

(a) SMTP	1. Application Layer
(b) BGP	2. Transport Layer
(c) TCP	3. Network Layer
(d) PPP	4. Data link Layer
	5. physical Layer

Ans a-1, b-4, c-2 d-3

Q3) what is the principal difference between connectionless communication and connection oriented communication?

Ans Connectionless Service: In this service there is no dedicated line between sender and a receiver

* The packet will transfer from sender side to receiver side in different routing paths.

Connection Oriented Service: In this service we first establish a connection, use that connection and then release connection

* Connection Oriented Service provide a dedicated path during communication.

Q4) What is the main difference between TCP and UDP?

Ans

TCP	UDP
• TCP is a connection oriented protocol.	• UDP is a connectionless oriented protocol.
• TCP assure reliable delivery of data to the destination.	• UDP does not assure reliable delivery of data to the destination.
• TCP provides extensive error checking mechanisms such as flow control and acknowledgment of data	• UDP does not provide error checking mechanism such as flow control and acknowledgment of data.
• Retransmission of loss packets is possible	• There is no retransmission of lost packets.

Q.5) Briefly summarize the principles that were applied to design Seven Layers in OSI model.

Ans The Seven layers of the OSI model were designed to provide a structured framework for network communication with each layer serving a specific purpose.

1) physical layer: Deals with the physical transmission of data over the network medium, focusing on the hardware aspects like cables, connectors, and signal encoding.

2) Data Link Layer: Manages the reliable transmission of data frames between directly connected nodes, addressing issue like error detection and correction as well as data framing.

3) Network Layer: Responsible for routing and forwarding data packets between different networks, using logical addressing (IP addresses) to make decision.

4) Transport Layer: Ensures end to end communication by handling flow control, error correction, and segmenting or reassembling data into manageable chunks.

5) Session Layer: Establishes, maintains and terminates sessions between applications, providing synchronization and dialogue control.

6) Presentation Layer: Focuses on data translation encryption, and compression to make sure that data can be understood by both sender and receiver

7) Application Layer: The top layer where applicati interact with the network, enabling user-leve services like e-mail, web browsing, and file transfer.

Q6) List out the service primitives highlighting the functionality of each used for implementing a simple Connection Oriented service.

Ans There are 6 services primitive of a connection oriented Service

Primitive	meaning
1. LISTEN	→ waiting for an incoming Connection.
2. CONNECT	→ Establish a connectio with a waiting peer.
3. ACCEPT	→ Accept an incoming Connection from a peer
4. RECEIVE	→ waiting for an incoming message
5 SEND	→ SEND a message to the peer.
6. DISCONNECT	→ terminate a connection

Q7) What is ad-hoc network? Briefly explain multipath yading.

Ans An ad-hoc network is decentralized and self-configuring network in which devices, such as laptops, smartphones, or IOT devices, can communicate with each other without the need for a central infrastructure or pre-established network.

Multipath yading refers to a phenomenon in wireless communication where multiple copies of a transmitted signal take different paths to reach the receiver. These multiple paths can result from signal reflections, scattering and diffraction in the environment.

Q8) Assume you want to send 8 bits at 600bps over an ordinary telephone line of bandwidth 3 KHz. Calculate the highest harmonic passed through telephone line.

Ans In this case: Given

Band rate (B) = 600bps

Band width (W) = 3KHz = 3000Hz

According to the Nyquist theorem;

$$\text{Highest Harmonic (H)} = \frac{\text{Band rate}}{2}$$

$$= \frac{600\text{bps}}{2} = 300\text{Hz}$$

So the highest harmonic passed through Telephone Line is

300Hz

Q9) What is the maximum data rate in a noiseless 6 KHz channel, transmitting 16 bit signals?

Ans In this case:

Given

Bandwidth (B) = 6 KHz = 6000Hz

Number of bits (n) = 16 bits

Using the Nyquist theorem:

Maximum data rate = 2 x Bandwidth

= 2 x 6000

= 12,000 bps

So the maximum data rate in this noiseless 6 KHz channel.

Q10) What is the maximum data rate in a noisy 3-KHz channel with SNR 30dB?

Ans $R = B * \log_2(1 + SNR)$

$SNR_{dB} = 10 * \log_{10} SNR$

$30 = 10 * \log_{10} SNR$

$\log_{10} SNR = \frac{30}{10}$

$SNR = 10^3$

$= 1000$

$\therefore R = 3 * \log_2(1+1000)$

$= 3 * \log_2 001$

$= 3 * 9.967$

$= 29.901$ Kbps / 30 Kbps

Q11) It is desired to send a sequence of computer screen images over an optical fiber. The screen is 2560 x 1600 pixels, each pixel being 24 bits. There are 60 screen images per second. How much bandwidth is needed, and how many microns of wavelength are needed for this band at 1.30 microns?

Ans Image size:

The screen resolution is 2560 x 1600 pixels and each pixel is 24-bits. So the total data per image is:

Data per image = 2560 x 1600 x 24 bits =

= 98304000 bits

Frame rate: 60 screen images per second

The total data rate per second bandwidth:

Data rate per second = Data per image x Frame rate

$= ((2560 \times 1600 \times 24) \times 60)$ bit/sec

= 5898240000 bit/sec

Next we need to convert the data rate to a more common unit like megabits per second (Mbps):

1 byte = 8 bits.

1 (Megabits (Mb) = 1,000,000 bits.

∴ Data rate per second = $\frac{2560 \times 1600 \times 24 \times 60}{8} \text{ M}$ $\frac{}{1,000,000}$

$= \frac{245760000 \times 60}{1000,000}$

≈ 14740.56 Mbps.

And hence the bandwidth is at the wavelength of 1.30 microns.

Q12) Justify why the refractive index of cladding is less than that of core in an optical fiber cable used for transmission of signal. Also state the difference between multimode and single mode fiber.

Ans → The refractive index of the cladding is lower than that of the core in optical fiber to enable total internal reflection, which keeps light signals confined within the core by ensuring that light reflects off the core cladding boundary. This prevents signal loss and maintain signal integrity during transmission.

multimode fibre : A fibre having different modes from single line source called multimode fibre

Single mode fibre : A fibre having only one mode from single line saure called single mode fibre.

* Single mode fibre is more expensive compare to multimode fibre.
* Currently available single mode fibre can transmitt 100 GBP's data for 100 Km without any amplification

Q13) What is the minimum bandwidth needed to achieve a data rate of B bits/sec if the signal is transmitted using NRZ and Manchester encoding?

Ans The minimum bandwidth needed to achieve a data rate of B bits per second is B/2 hertz for NRZ (Non-Return-to-Zero) encoding and B hertz for Manchester encoding ....

Q14) What signal to noise ratio is needed to put a T_1 carrier on a 50kHz line?

Ans $R = B * \log_2(1+SNR)$

In this case:

The Bandwidth (B) = 50KHz

T_1 carrier has data rate = 1.544 Mbps

= 1544000 bps

$1544000 = 50,000 \log_2(1 + SNR)$

Divided both sides by 50,000 we get:

$$31 = \log_2(1 + SNR)$$

$$2^{31} = 1 + SNR$$

$$SNR = 2^{31} - 1$$

$$SNR \approx 2147483647 - 1$$

$$\approx 2147483646$$

Q15) Two hosts are connected via a packet switch with 107 bits per second links. Each link has a propagation delay of 20 microseconds. The switch begins forwarding a packet 35 microseconds after it receives the same. If 10000 bits of data are to be transmitted between the two hosts using a packet size of 5000 bits, what is the time elapsed between the transmission of the first bit of data and the reception of last bit of the data?

Ans The time to transmit 10,000 bits:

$$\text{Time} = \frac{\text{Data size}}{\text{Link rate}} = \frac{10,000 \text{ bits}}{107 \text{ bit per second}} \approx 93.46 \text{ seco}$$

Time for signal propagation:

Total propagation Time = 2X (2x propagation Delay + Switch forwarding Delay)

= 2X (2X 20 microsecond + 35 microseconds)

$2 \times 75 = 150$ microseconds

$= \frac{150}{1000000} = 0.00015$ seconds

Total time elapsed = (Time to transmit data + Total Propagation Time)

≈ 93.46 seconds $+ 150$ microseconds

$= 93.46$ seconds $+ 0.0015$ seconds

$= \boxed{93.46015 \text{ seconds}}$