Course Code	:	**CS-68**
Course Title	:	**Computer Network**
Assignment Number	:	**BCA (6)/-68/Assign/2012**
Maximum Marks	:	**100**
Weightage	:	**25%**
Last Date of Submission	:	**30th April 2012/30th October, 2012.**

**1)   (a)   What do you understand by the term computer network?
                   List the key component of a network.   (5 Marks)**

Ans:

A network is a group of computers and computing devices interlinked each together, so that user can send the data from one computer to another computer. It is a medium to connect the people over the world.

A computer network**,** often simply referred to as a network, is a collection of hardware components and computers interconnected by communication channels that allow sharing of resources and information.

Advantage

- Data sharing.
- Device sharing.
- On-line education.
- On-demand video.
- On-line banking.
- News broadcasting.

Key Components are:-

   I.   **Router:** - Routers are devices (computer) which contain software that helps to determine the best path from the existing (available path) path. It is used to connect similar or dissimilar network (**LAN or WAN**). A router between two LANs receives message from both networks, checks their destinations. And transmit the message to required LAN.

  II.   **Gateway: -** it is used to connect totally dissimilar network. It performs protocol conversion for all seven OSI layer. It can recover e-mail message in one format and convert it into another format. We can connect system with different protocol, Language, and architecture with gateway.

 III.   **Repeaters:** A repeater is an electronic device that receives a signal, cleans it from the unnecessary noise, regenerates it and retransmits it at a higher power level, or to the other side of an obstruction, so that the signal can cover longer distances without degradation. In most twisted pair Ethernet configurations, repeaters are required for cable which runs longer than 100 meters. Repeaters work on the Physical Layer of the OSI model.

IV. **Hubs:** A network hub contains multiple ports. When a packet arrives at one port, it is copied unmodified to all ports of the hub for transmission. The destination address in the frame is not changed to a broadcast address. It works on the Physical Layer of the OSI model.

V. **Switches:** A network switch is a device that forwards and filters OSI layer 2 datagrams (chunk of data communication) between ports (connected cables) based on the MAC addresses in the packets. This is distinct from a hub in that it only forwards the frames to the ports involved in the communication rather than all ports connected. A switch breaks the collision domain but represents itself a broadcast domain. Switches make forwarding decisions of frames on the basis of MAC addresses.

(b) **Differentiate between OSI and TCP reference model in terms of layers,**
Functionality of each layer and important protocols at each layer.
(9 Marks)

Ans:

Application	SMTP	HTTP	FTP	DNS	WWW	TELNET
Presentation session	Application Layer					
Transport	TCP		UDP	Transport Layer		
Network	ARP	RARP	IP	ICMP		
	Internet/Network Layer					
Data link Layer	Interface Layer					
Physical Layer						

Network interface layer : It deals with hardware level like transmission media connection and other component.

Internet layer : This layer is responsible for the format of datagram that is defined by IP and routing algorithm. There are various protocols comes under this layer.

Transport layer :- It is responsible for transferring a message or packet from one device to another device successfully.

Application layer :- It is a combination of application, presentation and session layer. It allows user to run various application on internet.

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Protocols are:-

- ARP (ADDRESS RESULATION PROTOCOL):- it is used to find physical address of machine, if IP address is known.
- RARP (REVERSE ADDRESSRESULATION PROTOCON):- It is used to find the IP address of machine when physical address is known.
- ICMP (INRENET CONT ROL MESSAGE PROTOCOL):- It is responsible for best effort delivery. In case of massage failure it is used to send a notification to sender.
- IP (INTERNET PROTOCOL):[It is used to find destination address where data to be sent.
- SMTP: -It is used to transfer a mail from one network to another network.
- FTP (FILE TRANSFER PROTOCOL):- It is used to transfer a file from one computer to another computer.
- DNS (DOMAIN NAME SYSTEM):- It describes the domain of website where sites are stored in particular domain. For example= .com, .org, .in.
- WWW (WORLD WIDE WEB):- it is a world web directly, where web sites are associated with it.
- HTTP (HYPRETEXT TRANSFER PROTOCOL):- It is used to transfer all linked file of web-site.
- TELNET:-It stands for tele network. It is a computer or computing device that is used for remote login. It accesses the user ID and password and makes connection with server.

	OSI Reference Model		TCP/IP Model
Service, interface and protocol	Service, interface and protocol are not clearly defined. For example, the only real services offered by the Internet layer are - Send IP Packet - Receive IP Packet	⇨	Service, interface and protocol are clearly defined. It can be replaced relatively easily as the technology changes, which is one of the main objective of layered protocols.
Functionalities	Because models were invented before protocols, functionalities put in each layer are not very optimized.	⇨	In this case, the protocols have been invented before models, so the functionalities are perfectly described.
Numbers of layers	Seven layers, Network (Internet), Transport and Application layers being similar to TCP/IP	⇨	Only four layers.
Connectionless/ Connection-	Both connectionless and connection-oriented	⇨	Only one mode in the network layer

oriented communication	communication is supported in the network layer, but only connection-oriented communication in the transport layer.	(connectionless) but both modes in the transport layer are supported, giving the users a choice.

**(c)** **Describe the following transmission techniques with examples:**

    (i)   Simplex
    (i)   Half Duplex
    (ii)   Full Duplex   **(6 Marks)**

Ans:

In Simplex Mode, the communication channel is used in one direction; the receiver receives the signals from the transmitting device. A typical use is to gather data from a monitoring device at a regular interval. The simplex mode is rarely used for data communication.

A ————————————→ B

A to B only
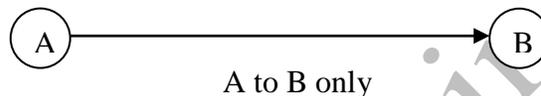
Duplex mode, the communication is possible from both of directions but only one direction can send data at a time. When **A** send data **B** receive it only and when **B** sends data **A** receives it only. The analogues example of this mode is the old wireless system (walkie-talkie) which is used in either transmit mode or receive mode.

A to B or B to A one at a time

A ————————————→ B

A ←———————————— B

In full duplex mode, the communication is possible from both of directions simultaneously. Typical example of this mode of transmission is the telephone in which both parties talk to each other at the same time.

A to B and B to A simultaneously

A ◄————————————► B
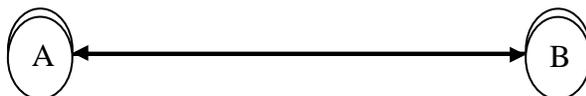
(d) **Discuss the characteristics of broadband coaxial cable.** **(5 Marks)**

Ans:

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Co- axial cable: - it consists of a stiff copper wire as the core, surrounded by an insulating material. The insulator is encased by a mesh conductor. The outer mesh conductor is covered by the plastic. The signal is transmitted through the inner copper wire(copper core).
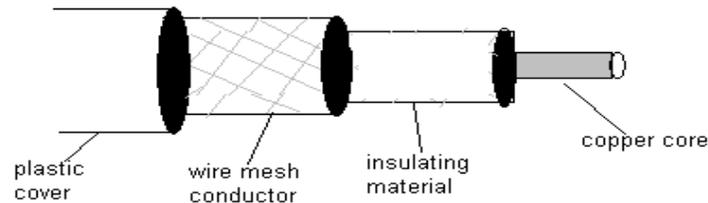
There are two type of co-axial cable:-

50 ohm and 75 ohm, 50 ohm is used for digital transmission for computer. And 75ohm is used for analog transmission for TV.

Advantage:

- It is used for digital and analog transmission
- It is used for longer distance
- Higher data transfer rate (100 mbps)

Dis-advantage:

- Difficult to connect to network device
- It requires connector.

**2)	(a)	List three points for each that differentiate one from the other in each of the following pairs:**
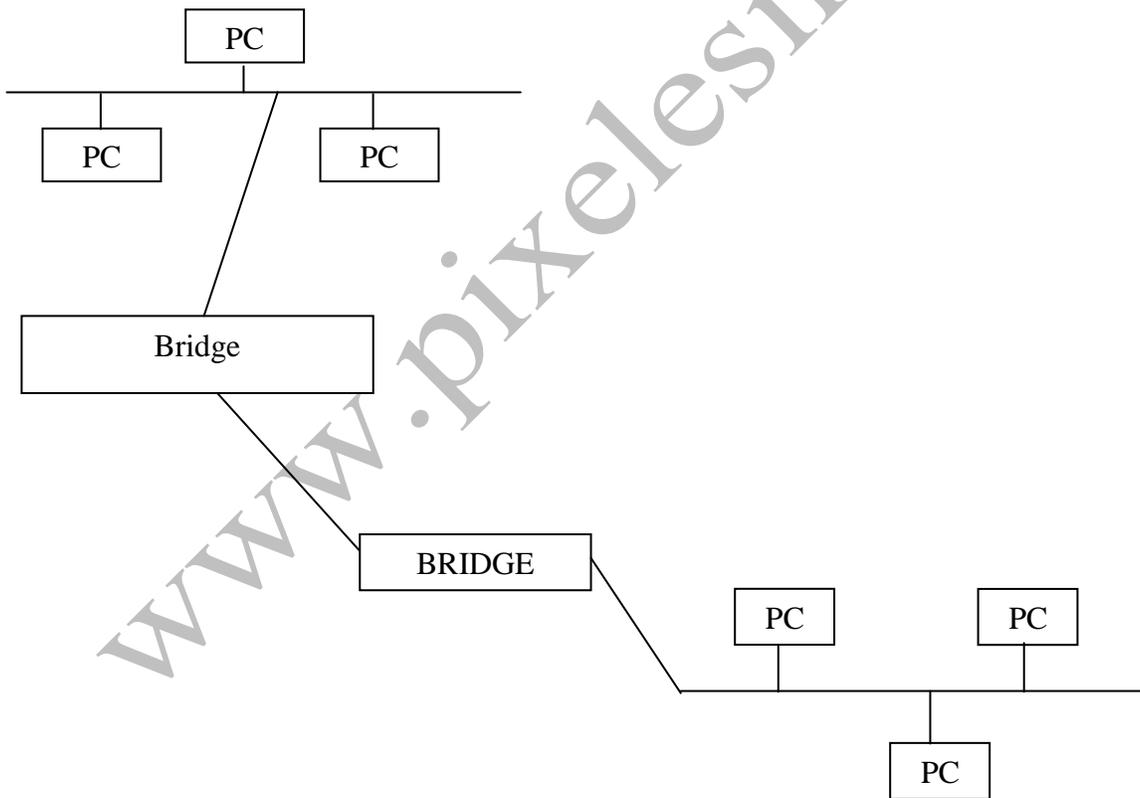		**(i)	Local and remote bridges**

Ans:

Local Bridge: - it is used to connect two segments of network those are physical close together in the same building or on the same floor etc. **Local** bridge physically separates a network segment by managing the traffic. The two segments are physically close together in the same building, on the same floor, etc. only one bridge is required.
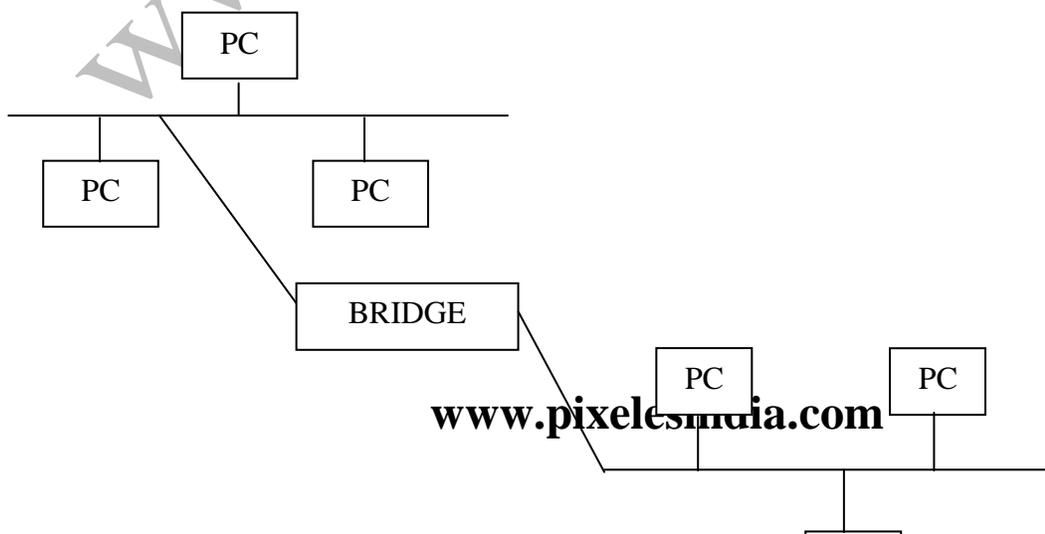
Segment A   Segment B

Remote Bridge: - these are used in pairs. It is required when two network segment are physically for a part in a building or different building. It is also used in remotely segment network.

```
                    ┌──────┐
                    │  PC  │
        ┌───────────┴──┬───┴──────────────┐
    ┌───┴──┐        ┌──┴───┐
    │  PC  │        │  PC  │
    └──────┘        └──────┘
                │
        ┌───────┴──────────────┐
        │       Bridge         │
        └──────────┬───────────┘
                    │
            ┌───────┴──────────┐
            │     BRIDGE       │
            └────┬─────────────┘
                 │     ┌──────┐       ┌──────┐
                 │     │  PC  │       │  PC  │
                 └─────┴──┬───┴───┬───┴──┬───┘
                          │    ┌──┴───┐  │
                          │    │  PC  │  │
                          └────┴──────┴──┘
```

(ii)   Constant bit rate and variable bit rate in ATM

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Ans:

The CBR(Constant bit rate) service category is used for connections that transport traffic at a constant bit rate, where there is an inherent reliance on time synchronization between the traffic source and destination. CBR is tailored for any type of data for which the end-systems require predictable response time and a static amount of bandwidth continuously available for the life-time of the connection. he amount of bandwidth is characterized by a Peak Cell Rate (PCR). These applications include services such as video conferencing, telephony (voice services) or any type of on-demand service, such as interactive voice and audio.

The ABR(variable bit rate) service category is similar to nrt-VBR, because it also is used for connections that transport variable bit rate traffic for which there is no reliance on time synchronisation between the traffic source and destination, and for which no required guarantees of bandwidth or latency exist. ABR provides a best-effort transport service, in which flow-control mechanisms are used to adjust the amount of bandwidth available to the traffic originator. The ABR service category is designed primarily for any type of traffic that is not time sensitive and expects no guarantees of service.

       (iii)   TDM and FDM

Ans: In FDM technique, a logical channel is divided into different frequency ranges. Each user having a separate frequency value and data can be transmitted through separate frequency line. A television channel is divided into subcarrier frequencies for video, color, and audio. For **Example:** - TV transmission uses FDM technique. Basically FDM requires guard bands to keep signal.

Time-division multiplexing (**TDM**) is a type of digital or analog multiplexing in which two or more signals or bit streams are transferred simultaneously as sub-channels in one communication channel, but are physically taking turns on the channel. The time domain is divided into several recurrent **timeslots** of fixed length, one for each sub-channel. One TDM frame consists of one timeslot per sub-channel. **For example**: - Broadcasting advertisement and programme using same channel.

      (iv)   Datagram and Virtual Circuit

Ans:

Data gram: - **In datagram**, each packets is transmitted independently on different path through the network. Packets may be re-ordered, dropped or delivered in wrong sequence. The communication protocols provide error recovery and sequencing of packets at the destination.

Virtual circuits:- A fixed logical path exists between sender and receiver that means a path is establish before any packets are send, this path remain unchanged during this session.

| Virtual Circuit	Datagram
Host to host address is needed in link setup only	**Host to host address is always needed in sending the datagram (Embedded in the datagram itself)**
Errors is handled by subnetwork. Host will receive the packets in correct sequence.	**Error checking is required by host to resemble the packet and find out the missing**

	packets.
Messages passed in order to the network.	messages may be out of order in the communication sub-network
Connection setup is initially required prior to sending data	Connection setup is not required
Network component failure in path may affect the result	Is a flexible foundation to support a range of higher level protocols which can provide for additional network services
Less overhead in addressing embedded in the packet	Overhead in addressing
Example is X.25 Level 3	Example is Internet Protocol of (TCP/IP)

(v) Analog and Digital signals

Ans: **Analog: - in analog signal**, the transmission is continuous with respect to time and takes on any value within a given range of value. For example: human voice, music etc.
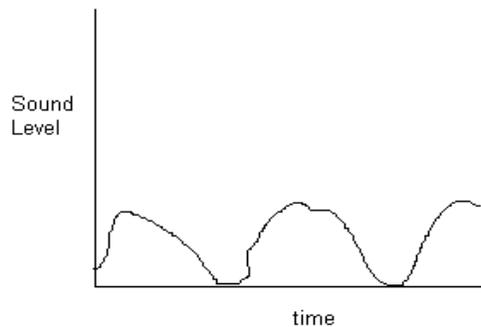
Digital: - A digital single may take on only discrete set of values within a given range. For example: computer and computer-related equipment produce digital signal.
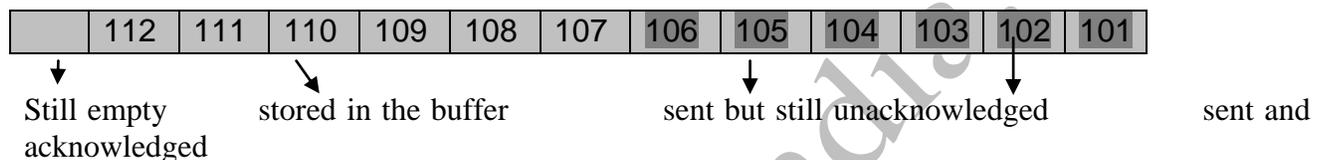

Modem is a communication device that is used to convert Digital signal to analog signal.

(b) **Explain sliding window protocol with the help of a suitable diagram.**
(5 Marks)

Ans:

In sliding window protocol, a window is maintained for each connection. The window defines the size of the buffer e.g. the total number of bytes that can be sent by a terminal at a given time shown in figure. This also shows the total number of blocks signifies the total size of window. The sliding window also keeps track of bytes which have been sent but are unacknowledged; bytes still stored in buffer but have not been sent.

| | 112 | 111 | 110 | 109 | 108 | 107 | 106 | 105 | 104 | 103 | 102 | 101 |

Still empty   stored in the buffer   sent but still unacknowledged   sent and acknowledged

Sliding window and sender node

Initially a window size is negotiated between the end terminals especially from the receiving side, which establishing a connection. Since TCP provides a byte stream connection, sequence numbers are assigned to each byte in the stream. TCP divides this contiguous byte stream into TCP segments to transmit them. Therefore, the window principle is used at the byte level, that is, the segments sent and acknowledgement received will carry byte sequence numbers and the window size is expressed as a number of bytes.

3) **(a)** **Describe packet switching and Circuit switching through illustration.**
**(5 Marks)**

Ans:
Circuit switching:- This was the first type of data transfer mechanism used. Circuit switching is used in the telephone network to transmit the voice and data signals. In a synchronous transmission, which involves transmission of voice, a synchronized connection must be made between each successive bit, character or event. To enable synchronized transmission, circuit switching establishes a dedicated, connection between the sender and receiver.
Packet switching:- in contrast of circuit switching, packet switching ensure that the network is utilized at all time. It does this by sending signals even in the small unused segment of the transmission- for example, between the words of a conversation or when a caller is put on hold.

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However, in packet switching there can be variations in the timing when the digital bits are received. For normal voice and data communications this is not a problem. For broadcast signal such as television, it is a huge problem that causes the picture to jerk and the audio to be out of synchronization with the picture. Data to be sent is broken down in to chunks or packet. Each packet is containing data and header information for control. At each node the packet is received, stored briefly and passes on.

(b)   Explain remote procedure call through illustration.   **(5 Marks)**

Ans:-
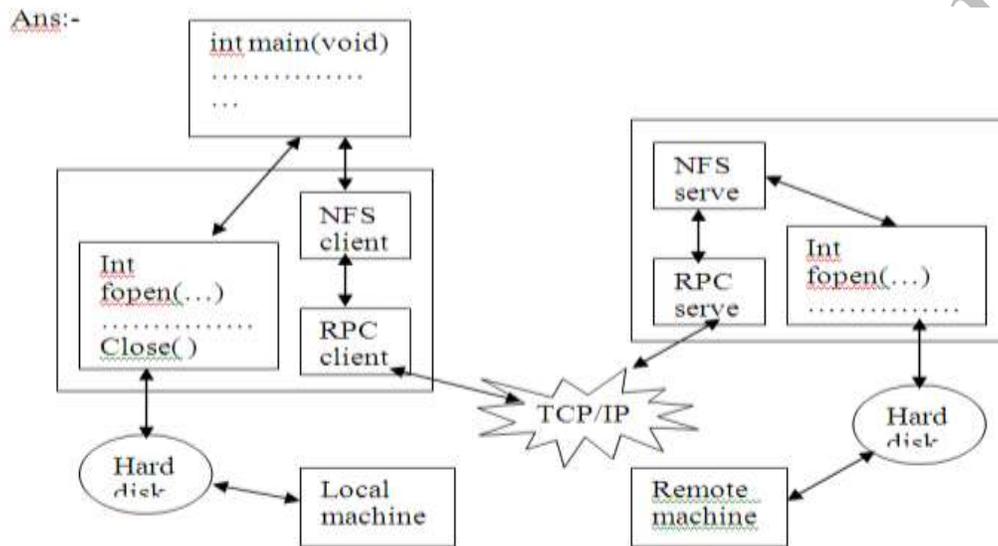
Concept of remote procedure call

RPC transfer the procedure call to another machine. Using RPC, local procedure calls are mapped onto appropriate RPC function calls. Illustration the process: a program issues a call to the NFS client process. The NFS client formats the call for the RPC client and passes it along. The RPC client transforms the data into a different format host; the RPC server retrieves the calls, reformats, and passes it to the NFS server. The NFS servers relay the call to the remote disk, which responds as if to a local call and opens the file to the NFS server. The same process is open its own host.

(c)   Explain the format of TCP header through illustration. (5 Marks)

Ans:
TCP provides reliable, ordered delivery of a stream of bytes from a program on one computer to another program on another computer. Besides the Web, other common applications of TCP

include e-mail and file transfer. Among its other management tasks, TCP controls segment size, flow control, the rate at which data is exchanged, and network traffic congestion.

TCP Packet Structure

A TCP packet consists of two sections, header and data. All fields may not be used in every transmission. A flag field is used to indicate the type of transmission the packet represents and how the packet should be interpreted. The header consists of 11 fields, of which 10 are required:
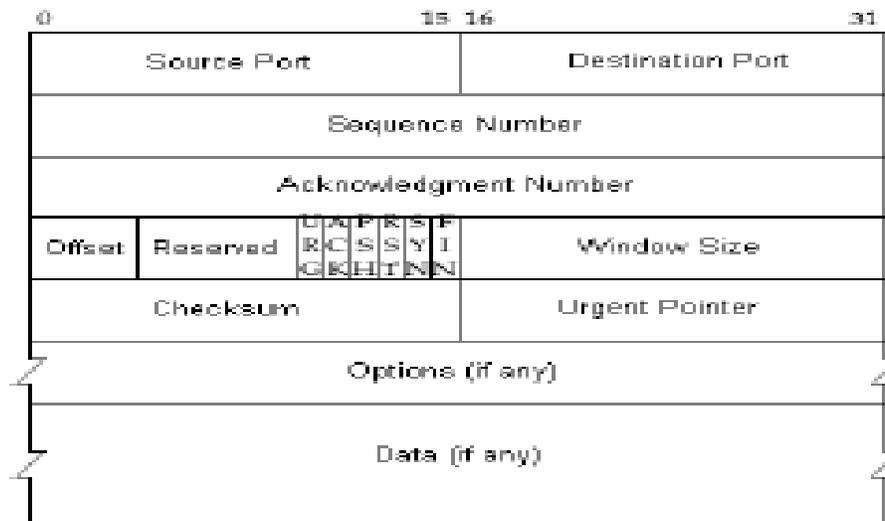
- **Source port**—identifies the sending application.
- **Destination port**—identifies the destination application.
- **Sequence number—**Used for assembling segmented data in the proper order at the receiving end.
- **Acknowledgement number**—The sequence number the sender (the receiving end) expects next.
- **Data offset—**the size of the TCP header, it is also the offset from the start of the TCP packet to the data portion.
- **Reserved**—Reserved for future use, should be set to zero.
- **Flags** (also known as control bits)—contains 6 1-bit flags:
  - URG—Urgent pointer field is significant.
  - ACK—Acknowledgement field is significant.
  - PSH—Push function.
  - RST—Reset the connection.
  - SYN—Synchronize sequence numbers.
  - FIN—No more data from sender.
- **Window—**The number of bytes the sender is willing to receive and starting from the acknowledgement field value.
- **Checksum**—used for error-checking of the header and data.
- **Urgent pointer**—If the URG flag is set, then this 16-bit field is an offset from the sequence number indicating the last urgent data byte.

- **Options**—Additional header fields (called options) may follow the urgent pointer.
- **Data**—the contents of this field are the user data being transmitted between two application level entities.

4) (a) Explain three different kinds of interfaces supported by ATM. (6 Marks)

Ans:
An ATM network consists of a set of ATM switches interconnected by point to point ATM links or interfaces. ATM switches supports three kinds of interfaces:
- User network interface (UNI)
- Network- node interface(NNI)
- Inter- carrier interface (ICI)
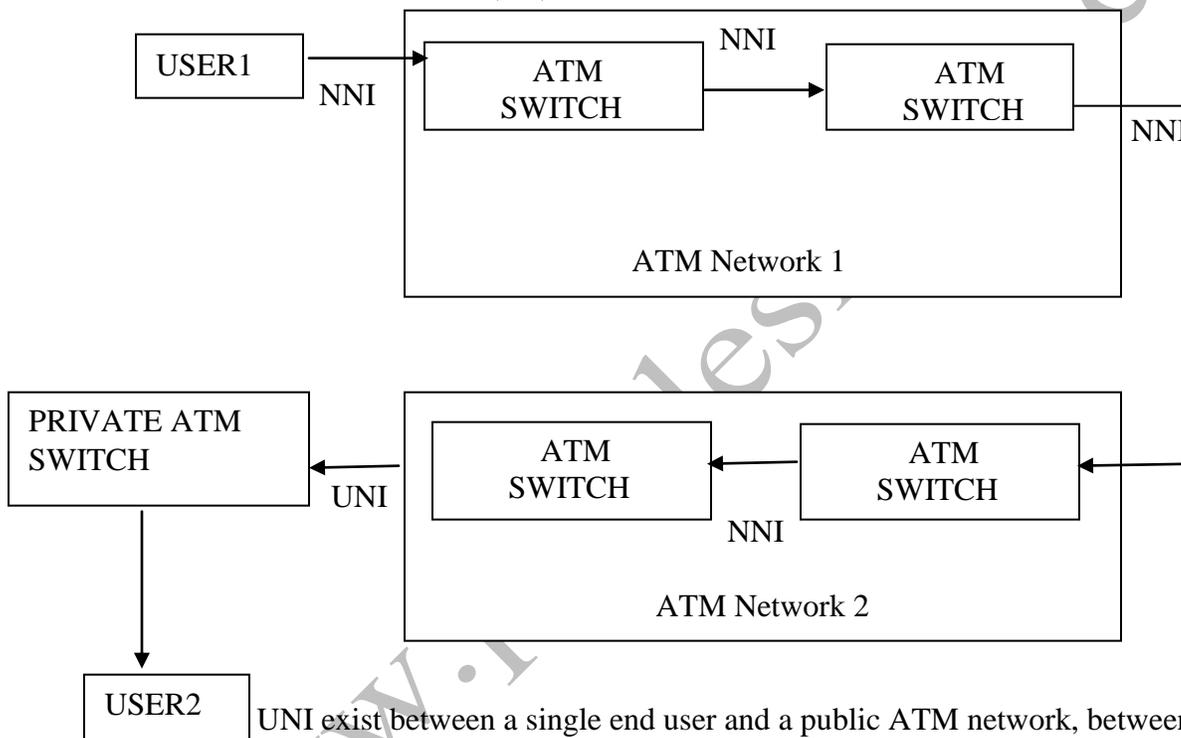
UNI exist between a single end user and a public ATM network, between a single end user and a private ATM switch, or between a private a private ATM switch the public ATM network

- The NNI exist between switches in a single public ATM network. NNI may also exist between two private ATM switches.

- The ICI is located between two public ATM networks.

(b) Explain ATM Adaptation layer protocols. (9 Marks)

Ans:

The ATM Adaptation layer (AAL) maps the higher level data in to ATM cells to be transported over the ATM network, i.e. this layer segments the data and adds appropriate error control information as necessary. It is dependent on the type of service (voice, data etc.) being transported by the higher layer.

Depending on the type of data, several types of AAL layers have been defined. However, no AAL is restricted to a specific data class or type; all types of data could conceivably be handled by any of the AAL. The various AAL protocols are defined as:

a) AAL 1

b) AAL 2

c) AAL ¾

d) AAL 5

It is divided into two sub layers

- SAR (Segmentation And Reassembly)
- CS (convergence Sub layer)

Segmentation And Reassembly: This is the lower part of the AAL. The SAR sub layers breaks packets up into cells on the transmission side and puts them back together again at the destination. It can add header and trailers to the data units given to it by the CS to form payloads. It is basically concerned with cells.

Convergence sub layer: the CS sub layer makes it possible to have ATM systems offer different kind of services to different applications. The CS is responsible for accepting bit stream or arbitrary length message from the application and breaking them into units of 44 or 48 bytes for transmission.

(c)   **Explain the advantage of ISDN.**   **(5 Marks)**

Ans:
There are many advantages of ISDN.

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- **Speed: -** the modem was a big breakthrough in computer communications. It allowed computers to communicate by converting their digital information into analog signals which could travel through the public phone network. There is an upper limit to the amount of information that an analog telephone line can hold. Currently it is about 56kbps. ISDN allows multiple digital channels to be operated simultaneously through the same regular phone ringing used for analog lines.
- **Multiple devices:-** Before the advent of ISDN it was necessary to have a phone line for each device that had to be used simultaneously. For example one line each was required for a telephone, fax, bridge/router and live video conference system. Transferring a file to someone while talking on the phone or seeing their live picture on a video screen would require potentially expensive phone lines.
- **Signaling:-** It provides a dedicated signals of channel which is conman to all B-channels: this is called channel signaling instead of the phone company sending a ring voltage signal to ring the bell on the phone "In-Band signal", it send digital packet on a separate channel "Out-of-Band-signal".

5) (a) Differentiate between Cell relay, Frame relay and Multirate circuit switching. (6 Marks)

Ans:

Multi rate circuit Switching:- In multirate switching, multiplexing is introduced. A station attaches to the network by means of a single physical link, which carries multiple fixed data-rate channels. Traffic on each channel can be switched independently through the network to various destinations. This is used for simple ISDN.

Frame relay:- frame relay is essentially identical to packet switching. Frame relay saw its development as a result of high data rates and low error rates on link in modern high speed communication systems. In old packet switching, there was considerable overhead involved in error recovery, redundancy enhancement and routing information. With frame relay the packets are now of variable length with low overhead, meaning that they were design to operate up to 2mbps.

Cell relay:- this is an evolution from frame relay and multi rate circuit switching. Cell relay uses fixed sized packet called cells. Cell relay allows for the definition of virtual channel with data rates dynamically defined. Using a small cell size allow almost constant data rate even though it uses packets.

(b) What data rate (basic rate) is supported by B channel and D channel in ISDN. (3 Marks)

Ans:

Basic rate interface consist of two 64 kbps B channels and one 16 kbps D channel for a total of 144kbps. BRI service is by far the most common and is typically found in homes and business alike.

Up to eight ISDN devices can be connected to a single BRI line and can all share the B channels and d channel. Individual devices are distinguished through the use of multiple subscriber numbers, with a different ISDN number assigned to each device. D channel signals automatically route communications to the appropriate ISDN device.

(c) **List different ISDN devices required to communicate with switch.**
(3 Marks)

Ans:

Baseband communication:- baseband communication is a type of digital data transmission in which each medium (wire) carries only one signal or channel at a time. In contrast, broadband transmission enables a single wire to carry multiple signals simultaneously.

Broadband communication:- broadband communication is a standard for transmitting a voice, video and data at same time over fiber optic telephone lines. Broadband ISDN can support data rates in excess of few million bits per second (bps).

(d) **Describe ATM cell structure with illustration** **(8 Marks)**

Ans:
ATM transmits all the information in small, fixed size packets cells. Each individual ATM cell consists of a 5-bytes cell header and 48 bytes of data. The ATM network uses the header to support the virtual path and the virtual channel routing, and to perform a quick error check for corrupted cells.

Bytes   5   48

Header	User data

An ATM cell

The header format
The structure of the header is different in UNI and NNI. In the network-network interface, the virtual path identifier field is expanded from 8 to 12 bits.

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8	7	6	5	4	3	2	1
Generic Flow Control*			Virtual path Identifier				
Virtual path Identifier			Virtual Channel Identifier				
Virtual Channel Identifier							
Virtual Channel Identifier			Pay load type ID			CLP	
Header Error control							
INFORMATION PAYLOAD (48 bytes)							

User network interface

8	7	6	5	4	3	2	1
Virtual path Identifier							
Virtual path Identifier				Virtual Channel Identifier			
Virtual Channel Identifier							
Virtual Channel Identifier			Pay load type ID CLP				
Header Error control							
INFORMATION PAYLOAD (48 bytes)							

Network-network interface

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