Syllabus

UNIT - 1

Fundamentals of Computer Network

Definition, uses of computer network, Network Devices: Bridge, Switch, Router, gateway, Access point.

Network Topologies: Bus, Star, Ring, Tree, Mesh, Hybrid. Types of Networks: LAN, MAN, WAN, PAN, Ad-Hoc Network, Networks Software, Protocol, Design issues for the Network Layers.

Types of Transmission Media: Guided media, Unguided media. Network Architecture: client - Server, Peer to Peer, Hybrid.

Network Models: OSI and TCP/IP Model. Types of Addressing: Physical addressing, Logical addressing, Port addressing and other addressing.

RARP : Reverse Address Resolution Protocol.
ICMP : Internet Control Message Protocol
IGMP : Internet Group Management Protocol.

Date
Page

UNIT- 2

Physical Layer

Functions of physical Layer: Data and Signals, Digital Transmission, Analog Transmission.

45 min — Transmission Impairment: Attenuation Distortion, Noise. Bandwidth Utilization: Multiplexing: Frequency - division Multiplexing Wavelength division, synchronous time division multiplexing, statistical time-division multiplexing.

20 min / 5 min — Spread Spectrum: Frequency Hopping (FHSS) and direct Sequence Spread spectrum (DSSS) Switching: circuit switching packet switching message switching.

10 min — Types of Cable Connection: Straight through connection, Cross over Connections. Line Coding Schemas: Manchester and Differential Manchester encodings.

⑦ DSR: Dynamic Source Routing.

⑧ SCTP: Stream Control Transmission Protocol

⑨ RCP: Rate Control Protocol

Hopping:

CIDR: Classless Inter-Domain Routing.

ARP: Address Resolution Protocol.

Date
Page

UNIT - 05 23/12/22

Network layer

8

8-10 Introduction: Function of Network layer, Switching Techniques: Circuit Switching, message Switching, Packet Switching. 3I

IP protocol: Classes of IP (Network addresing IPv4, IPv6, Network Address, Translation, Sub-netting, CIDR. Network layer Protocols: ARP, RARP, ICMP, IGMP,

5 Network Routing & Algorithms: Static Routing, Dynamic Routing, Distance Vector Routing Link State, Routing Path vector

Routing protocols: RIP, OSPF, BGP, MPLS

Routing in MANET: ADDV, DSR, Mobile IP.

① RIP: Routing Information Protocol

② OSPF: Open Shortest Path First

③ BGP: Border Gateway Protocol

④ MPLS: Multiprotocol Label Switching (IP).

⑤ MANET: Mobile Adhoc Network.

⑥ ADDV:

UNIT- 4.

Transport Layer

01 Process to process delivery, Services, Elements of Transport programming. Transport Protocols: Addressing, Connection establishment, Connection release. Flow Control & buffering, Multiplexing, Congestion control.

or Transport Layer Protocols: TCP & UDP, RTP, Congestion control & Quality of service (QoS), Differentiated Services, TCP & UDP for wireless networks.

UNIT- 5

Application Layer

03 Client Server Paradigm, Peer to Peer paradigm, Communication using TCP & UDP services, Domain Name System (DNS), Hypertext Transfer Protocol (HTTP), email: (SMTP, MIME, POP, Webmail), FTP, TELNET, Dynamic Host Configuration Protocol (DHCP), Simple Network Management Protocol (SNMP).

UNIT-6

Medium Access Control

Channel allocation : Static & Dynamic, Multiple Access Protocol : Pure & Slotted ALOHA, CSMA, WDMA, IEEE 802.3 Standards & frame formats, CSMA/CD. Binary Exponential Back-off algorithm, Fast Ethernet, Gigabit Ethernet, IEEE 802.15 and 802.16 Standards, frame formats CSMA/CA.

UNIT - 1

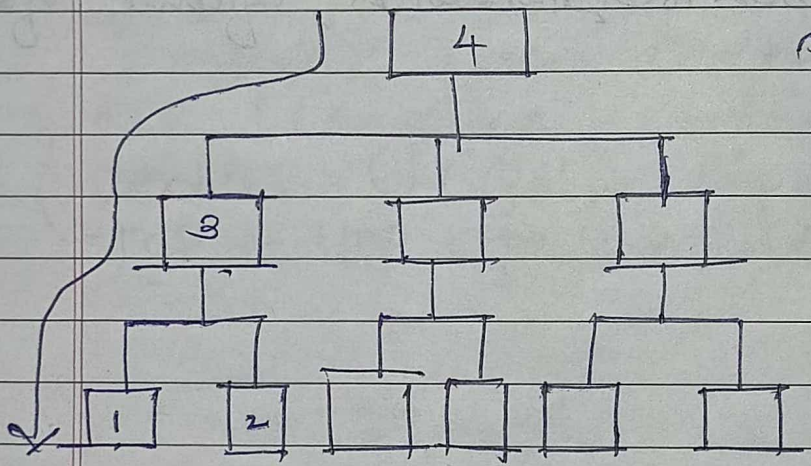
Fundamentals of Computer Network

29 | 7

#1 Types of Network. , Topologies

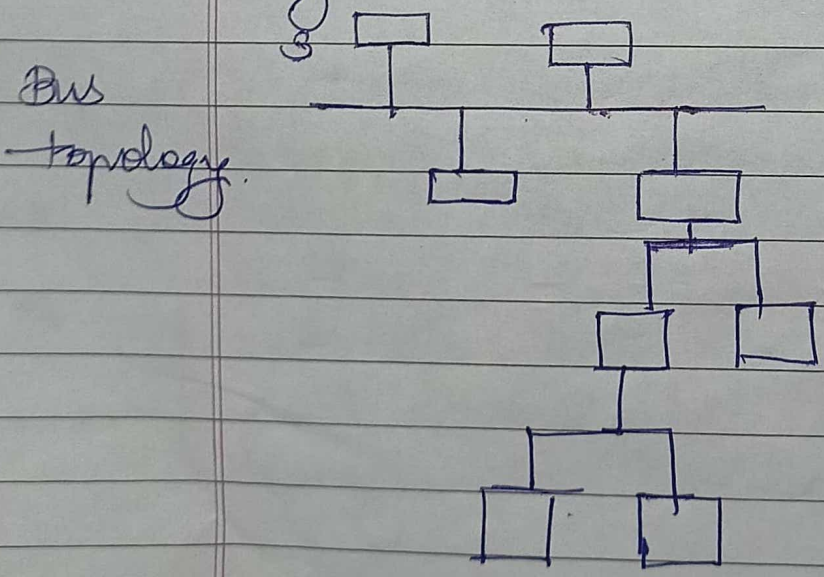
#2 Topologies: Hybrid, Hierarchical

① Hierarchical / Tree Structure.



Parent Node Control Childrens.

② Hybrid Structure. → Two topologies combine together.



Bus topology.

Tree Topology.

SDN → Software Designed Network.
Modem → ① Internal ② External.
Intranet → Private network for communication
B.W → Data transfer / time

#3 Networking Devices: Modem, HUB, Switches Router, Gateway, Bridge.

* Switches → Proper sending & receiving information and sends to intended device.

* Hub → Does not have proper sender & reciever directly sends the information.

* Router → Connects two machine and sends data to intended reciever.

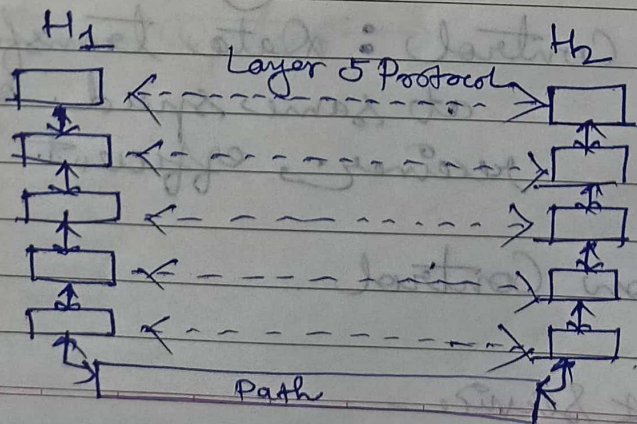
* Bridge → Connects two or more lan's & PAN's together.

#1 Ad-Hoc Networks: Random Network with spontaneous devices are connected for communication.
- Self-organized, self-configuring

- Wireless-Mesh Network:

#3. Network Software: Designing, implementation, performing various operations;

#4. Protocols: Helps administrator, for authenticating



VANETS → Varicular Adhoc Network.
SMANETS → Smart Phone Adhoc Network.

#5 Design Issues of Network layers:

① Reliability: (Trust): Data should be transfer to intended receiver.

- Working path → Routing path algorithms. for shortest path.
- Error correction / Error detection

② Evolution of Networks:

- Addressing Mechanism.
- Scalability problems
- Internetworking.

③ Resource allocation:

- Bandwidth Problems.
  Sol^n: Dynamic allocation of Bandwidth
  Statistical multiplexing;
- flow Control: Data transfer should be at same speed from sender & receiver → efficient communication.

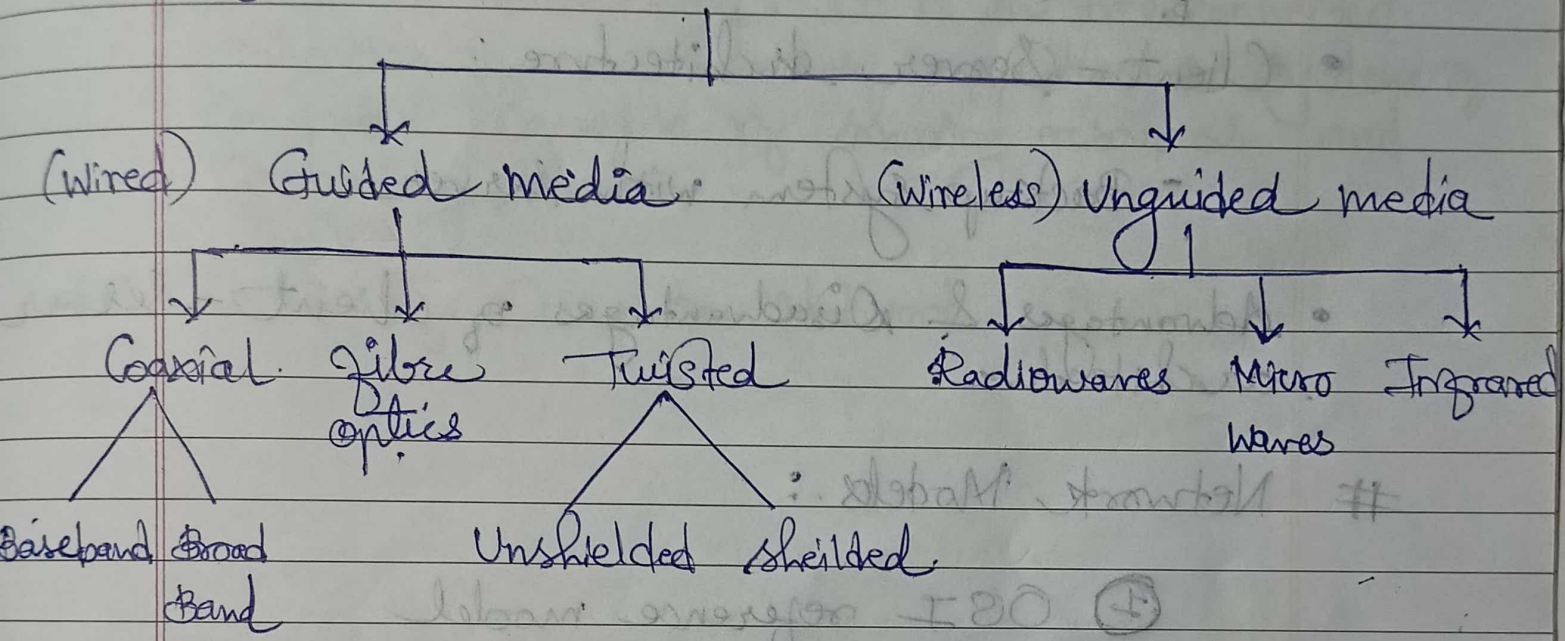
④ Congestion Control.

- Quality of Service

④ Security Issues:

- authentication, Confidential information, integrity.

#6 Types of Transmission Media



① Types of Guided Media:

- Twisted pair
- Coaxial Cable → Baseband, Broadband
- fibre optic →

NOS : Network Operating System.
CISCO packet tracer tool.

5/8/22

Network Architecture

- Peer to Peer :
  1. one to one network. (using star topology)
- Advantages of Peer-to-Peer Network :
  Disadvantages
  B.
- Client-Server architecture :
  - Backup system with server.
- Advantages & Disadvantages of client-server architecture.

Network Models :

1. OSI reference model
2. TCP/IP reference model

UNIT - 1

Fundamentals of Computer Networks.

#1 Network Topology: It is an art of connecting different computers in a network known as topology.

#2 Computer Networking: It is an interconnected collection of autonomous computers or system of computers capable of sharing resources and controlling services.

#3 Uses of Computer Network:

UNIT-2

22/8/2022
Tuesday

* Analog Transmission :

data formatting

① Bandpass filter

② low pass filter

* Digital - Analog Signal Conversion

- Amplitude shift keying
- Frequency shift keying
- Phase shift keying
- Radio frequency shift keying

* Analog - Analog Conversion

#1 Amplitude Modulation : Change in amplitude

#2 Frequency Modulation : Change in frequency.

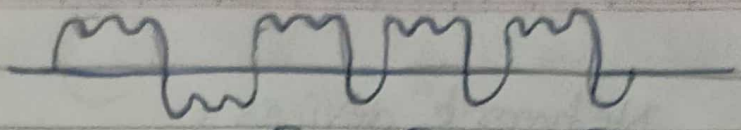
#3 Phase Modulation : Change in phase

* Transmission Impairment :

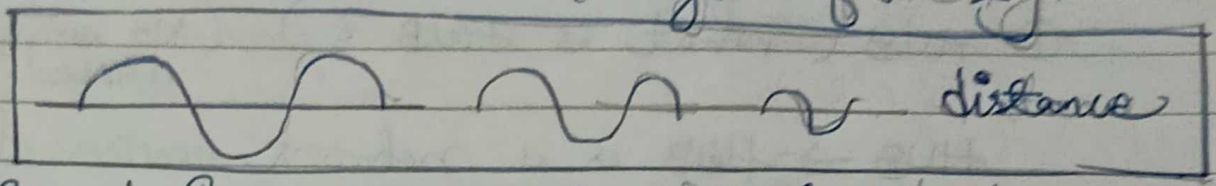
Causes : Attenuation
Distortion
Noise

Attenuation opposite Amplification

* Composite Signal:



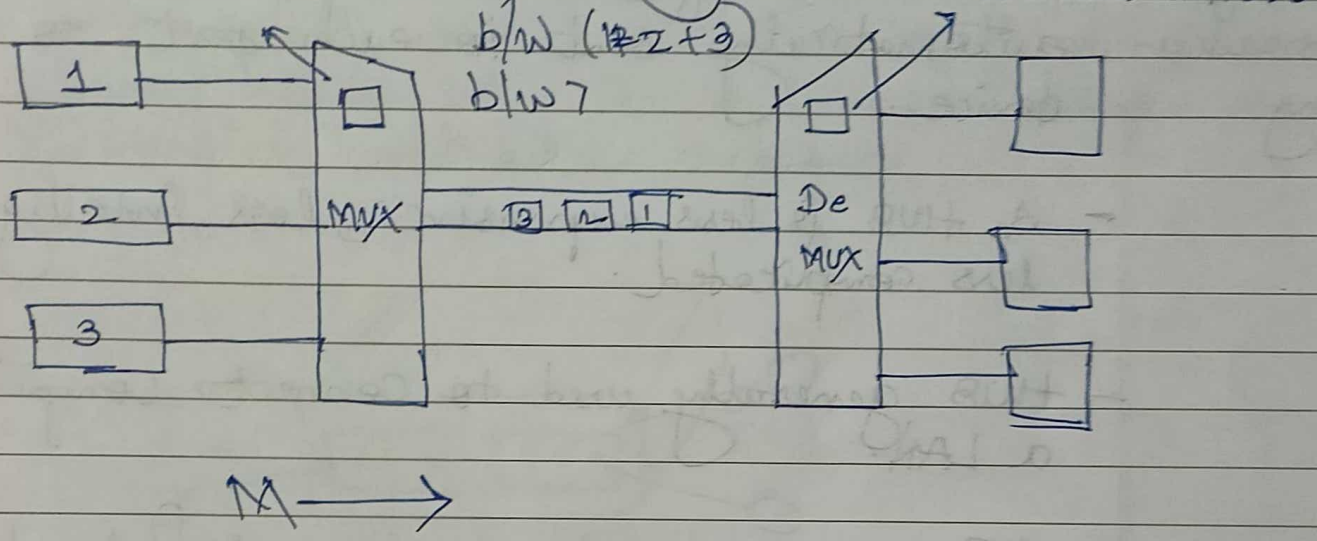
* Attenuation : decrease in strength of the signal.



Signal loses power at a its travel time.

26/8/2022
Friday

Multiplexing



M ⟶

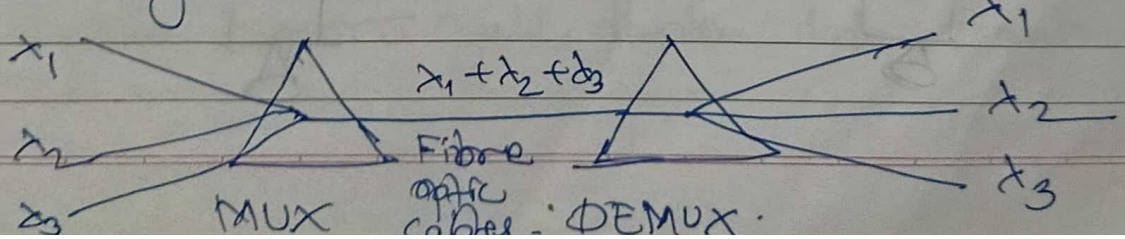
① Frequency Division Multiplexing.

② Wavelength Division Multiplexing

③ Time Division Multiplexing.

Synchronous Asynchronous.

* Optical Signals.



Learn Coding.

22/11 #2 Network devices:

① HUB (what is HUB ?) (No private messages allowed)

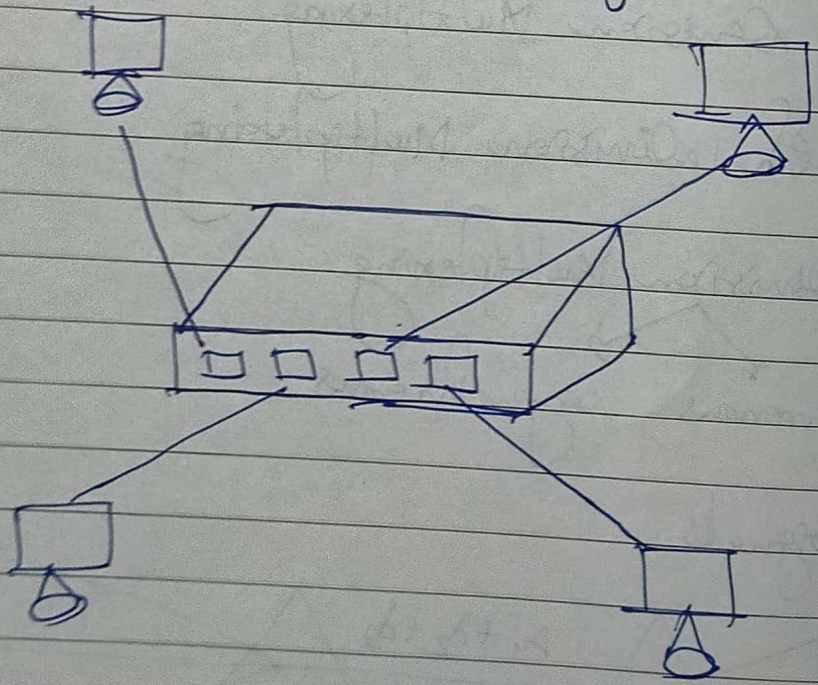
→ HUB → HUB is a network device that is used to connect multiple computers in a network.

used for broadcasting - All the information sent to the HUB is automatically sent to each port to every device.

- A HUB is less expensive, less intelligence & less complicated.

- HUB generally used to connect computers in a LAN.

- Transmission mode of HUB is half duplex.



Note: Switch is more intelligent than HUB.

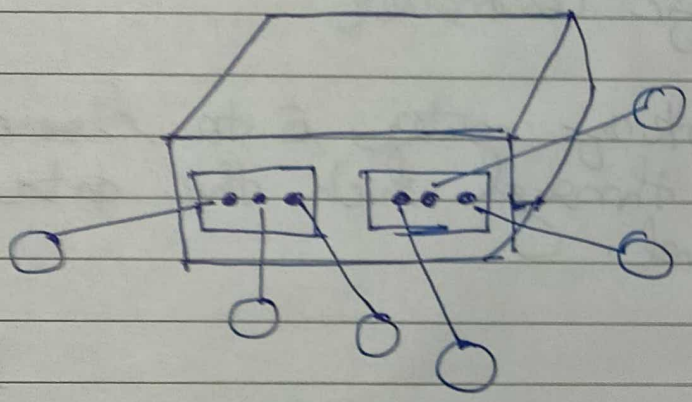
Date
Page

(3) Switch (what is Switch ? full explanation.)

→

Switch: Switch is a network device that connects multiple Computers together in the network.

- It is used to Sent the private message as well as their is no wasting of data.
- Switch can easily identify that which device is connected with which ports by using MAC address, thats why it is delivers message on particular destination machine.



Note: Intelligent than HUB.

Advantages: (1) It generally used to unicaste the msg

(2) It provides more Security than HUB.

(3) Switch Support full duplex data transmission mode.

④ It is used to send the data packet based on the MAC address.

⑤ If a node fails, there will be no effect in the entire network.

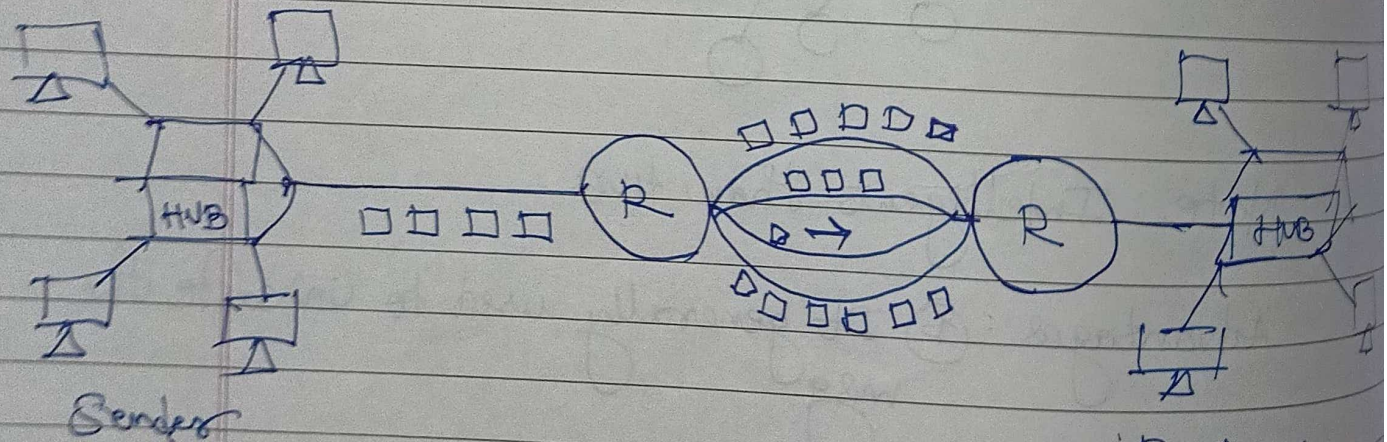
Disadvantage: If switch is failed then entire network will be failed.

② More expensive. ③ Difficult to setup.

③ What is Router?

Router is a network device which works as a traffic controller.

A main work of router is to choose a congestion free path through which the data packet will travel.



Note :- Router uses both LAN & WAN Network.

Asynchronous → Analog signal
Synchronous → Digital signal. (DHSS)

29/8/2022
Monday

Note - Time Division Multiplexing :
Combining several low rate channels into one high-rate one.

① Multiplexer → modulates signal, makes suitable by increasing strength so it can travel through the media.

② Synchronous Time - Division Multiplexing

* Keeps Sender & Reciever synchronized

- Interleaving

TDM Slot Comparison

Asynchronous → Time Slot are allocated unnecessarily. (equally time slot given).

Synchronous → Continuous format

* Spread Spectrum :

- Increases strength of input signal
- Interference / Jamming :
- Spread code

Jamming - Communication.

eavesdropping → checking of parameters, spying

FHSS : set of frequencies are used.

Seq : $\{f_1, f_2, f_3\}$ random code generated for modulation

* DSSS : Multiply each code data to spread data.

8/2/2022
Tuesday.

Switched Network.

(a) Switched Networks-

a. Circuit - Switched Network:
Channel is linked on each link.
Each link is normally divided into n channel.
by using FDM or TDM.

- key exchange algorithm
- Delay in circuit-switched network.

b. Message - Switching Technique:
Whole message is transferred from source to destination.

- Store & forward Strategy.
- Database will wait till the memory gets released.
- * अपेक्षित मेसेज संचयन जो पर्यंत मेमरी रिलीज फुल आहे.

Yashraj Deepak Devrat

Assignment - 1

Batch 2:

Q.1. Comparison of OSI and TCP/IP Model

→

OSI Model	TCP/IP Model
① Full form is Open Systems Interconnection.	① Its full form is Transmission Control Protocol.
② It follows horizontal approach.	② It follows vertical approach.
③ Separate Session Layer.	③ No session layer, Characteristics are provided by transport layer.
④ Separate Presentation Layer.	④ No presentation, characteristics are provided by application layer.
⑤ Transport layer guarantees the delivery of packet.	⑤ Transport layer does not guarantee delivery of packets.
⑥ It is General Model	⑥ It can not be used in any other applications.
⑦ It is developed by ISO (International Standard organization).	⑦ It was developed by ARPANET. (Advanced Research Project Agency Network).
⑧ Protocols are better hidden and can be easily replaced as the technology changes.	⑧ It is not easy to fit the protocols.

Q.2. Explain Port Addressing in Networking.

→ i. Port is a communication endpoint.

ii. Port number is assigned at transport layer depending upon services and applications.

iii. Port number is the part of addressing information used to identify the senders and receivers of messages in Computer Network.

iv. Different port numbers are used to determine what protocol, incoming traffic should be directed to.

v. They are divided into 3 categories:

① well known ports: 0 to 1023 are well-known port numbers as they were used by well known protocol series.

② Registered ports: 1024 to 49151 are registered ports numbers, i.e. it can registered to specific protocol by software corporations

③ Dynamic Ports: 49152 & 65536 are dynamic ports numbers & they can be used by anyone

vi. Purpose of port: Process to process Communication

vii. Size of port address: 16 bits $\approx 2^{16}$ address

Q.3 Explain Reliability as a design issue in network layers.

→ ① Reliability: It is a design issue in network, a network that operates correctly even when it is made up of unreliable components.

② Network channels & components may be unreliable, resulting in the loss of bits while data transfer. So, an important design issue is to make sure that the information transferred is not distorted.

③ It creates issue while routing & error control. It checks reliability of channels both at bit level & packet level. It is finding optimal route between two or more nodes in relation to time, distance etc.

Q.4. What are Ad-hoc networks? Explain with the help of its classification.

→ ① An Ad-hoc network is one that is spontaneously formed when devices connect and communicate each other.

② Ad-hoc networks are mostly wireless local area Networks.

③ The devices communicate with each other directly instead of relying on a base station or access points as in the wireless LAN for data transfer Co-ordination.

④ The Ad-hoc Networks are classified as:

i. Mobile Ad-hoc Networks (MANETs): This is a self-configuring, self organizing, wireless network of mobile devices.

ii. Vehicular Ad-hoc Networks (VANETs): This is a network formed by communication between moving vehicles and other roadside devices.

iii Wireless Mesh Networks & The devices connected to these networks forms wireless mesh, depending upon the mobility patterns nature of the devices and inter-device distances.

iv. Smart phone ad-hoc networks (SPANs): These are peer to peer network created by Smart-phones within range of each other without reporting any cellular carrier networks, wireless access points etc.

v. Wireless Sensor Networks (WSN): Sensors are portable devices that capture specific information room environment like temp-erature, humidity, traffic volume etc. WSNs form ad hoc networks to capture inform on the fly.

Q5 Explain Bus Topology ?

→ ① Bus topology is a network type in which every network device is connected to a single cable.

② It transmits the data from one end to another in a single direction. No bi-directional feature is in Bus Topology.

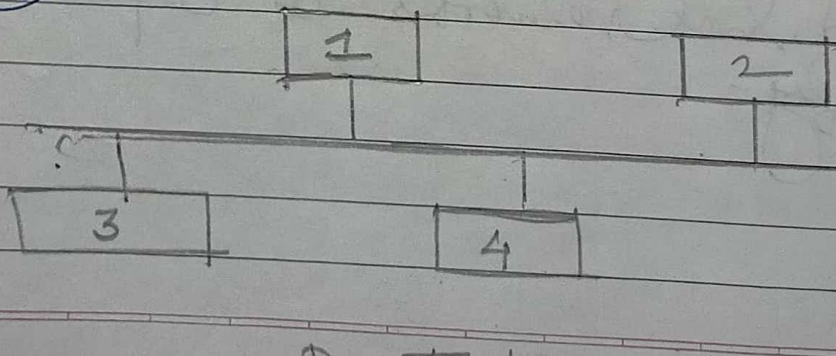
③ It is a multipoint connection and a non-robust topology because if the backbone fails the topology crashes.

④ In bus topology, various MAC protocols are followed by LAN ethernet connection like TDMA, Aloha, CDMA, etc.

⑤

Advantages	Disadvantages
① It is quite easy to setup.	① It offers limited flexibility for change
② Failure of one doesn't affect rest of the network.	② The signal on bus must be strong enough to reach the receiver.

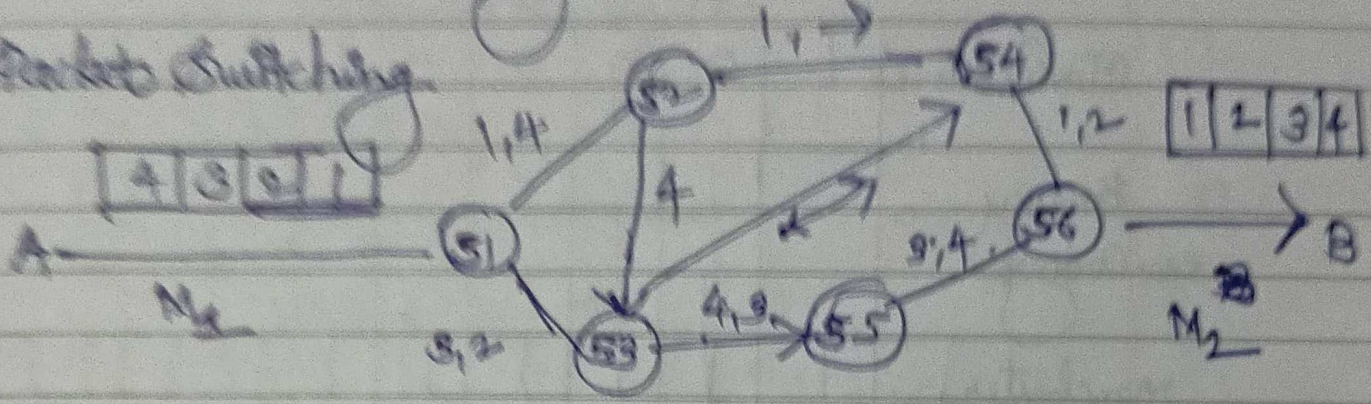
⑥



Bus Topology.

Chapter 8
Switching

* Packet Switching



Cable Connections.

Types of Cable Connections

1. Ethernet Cable

a.- Straight Through cable → RJ-45

- Connect 2 different types of devices.

b. Crossover Cable

* Line Coding Schemes:

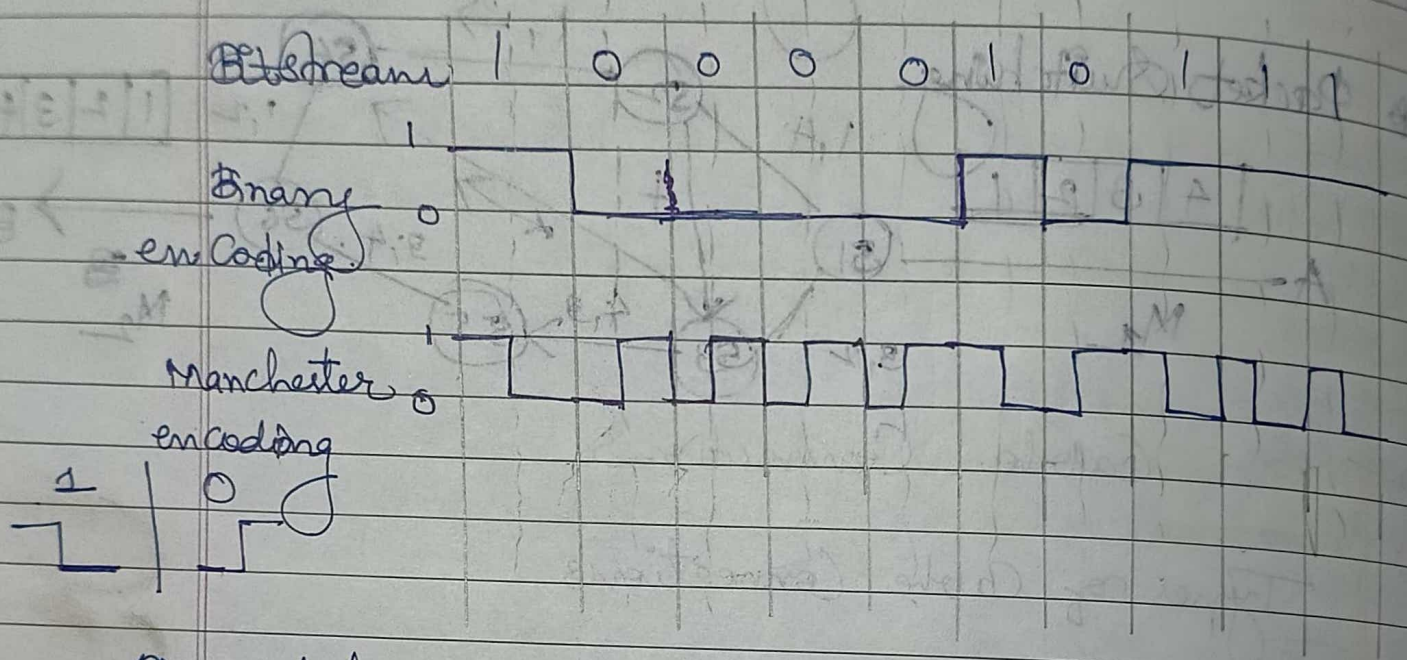
① Manchester
② Differential Manchester : NRZ-I & NRZ

Manchester:

* 1 period → two intervals
* 1 → high-low (1, 0)
* 0 → low-high (0 1)

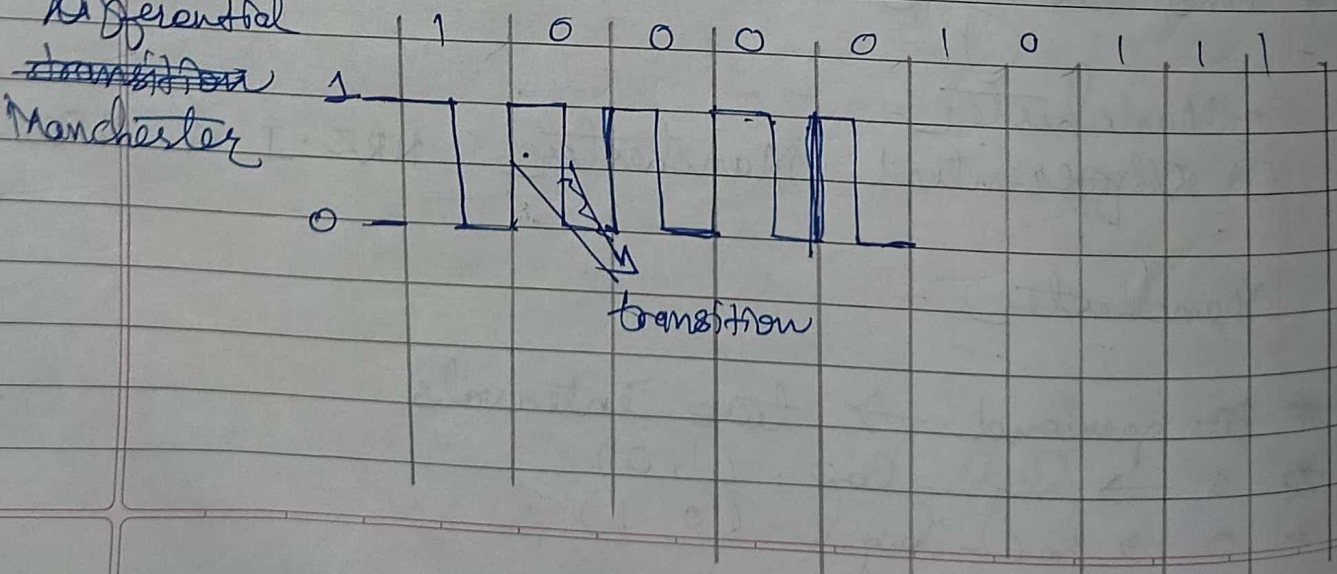
Differential Manchester :

Bit Stream : 10000/0111



Differential manchester

- 1 → (1, 0) } Initially
  0 → (0, 1) }
- 1 → Absence of transition.
- 0 → Presence of transition.



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96

14
8
128

Date:
Page

18/9/2020
Tuesday

16/9/2020
Friday

10:00 - 11:00

Network layer

1. Conversion of packets.
2. Routing
3. Jittles

* IP protocols.
  8 bits IPV4 → 32 bits
  16 bits IPV6 → 128 bits.

8 bits
01101010

2^8 → 256 hosts

$2^0, 2^1, 2^2, 2^3$
$2, 2, 2, 2$

Class A
Class B
class C
} LAN, WAN

Class D → multicasting
Class E → Research & development.

Priority bit Concept

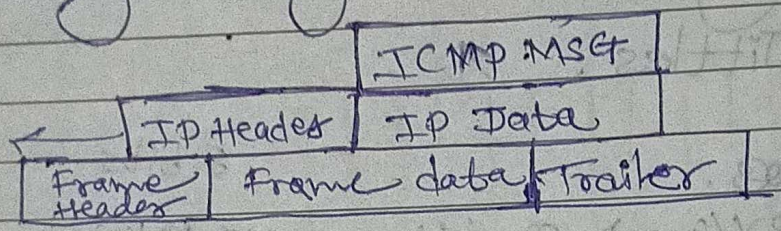
A → 0
B → 10
C → 110
D → 1110
E → 1111

Class A Range
Class B Range

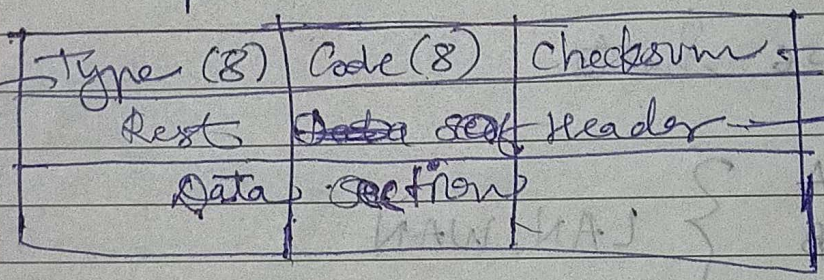
Datagram → Structure of packet.

22/9/2023
Friday. ICMP → Internet Control Message Protocol;

① No error reporting
② Query Management
} ICMP messages.

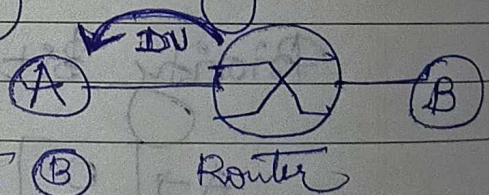


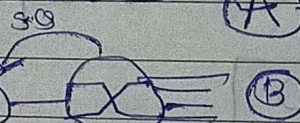
Encapsulation

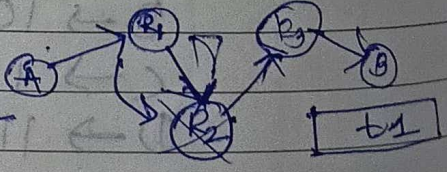


ICMP messages { Error messages
Query messages

Report Errors
- Destination Unreachable
- Source Quench.
- Time Exceeded (TTL)
- Parameter Problem

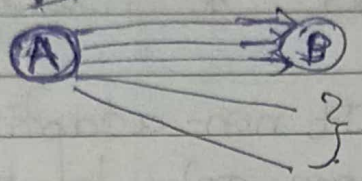






TTL(1)

Code 1 :



④ Parameter Problem :

Code 0 → Error / Ambiguity

Code 1 → Missing Values.

★ Query Management Messages.

① Echo request & reply messages.

② Timestamp.

Sending time, Receiving time, Reply time.

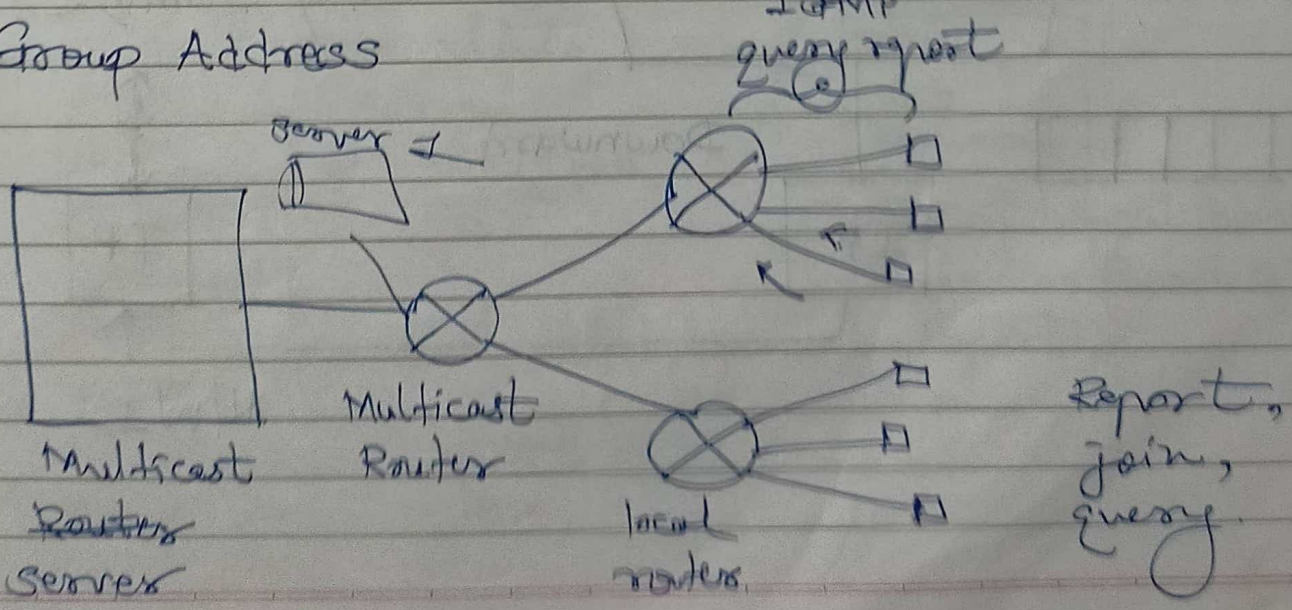
27/09/2022
Tuesday

IGMP

① IGMP v1 & IGMP v2, Message Format.

Time = 1 min
3 min

Group Address



Routing Algorithm

Date
Page

* Routing Algorithms * Routing Algorithms

① Static Routing : It non-adaptive routing.
Changes can be done only by network administr
High security.

② Dynamic Routing : adaptive routing.
Changes accordingly to Topology.
Low Security

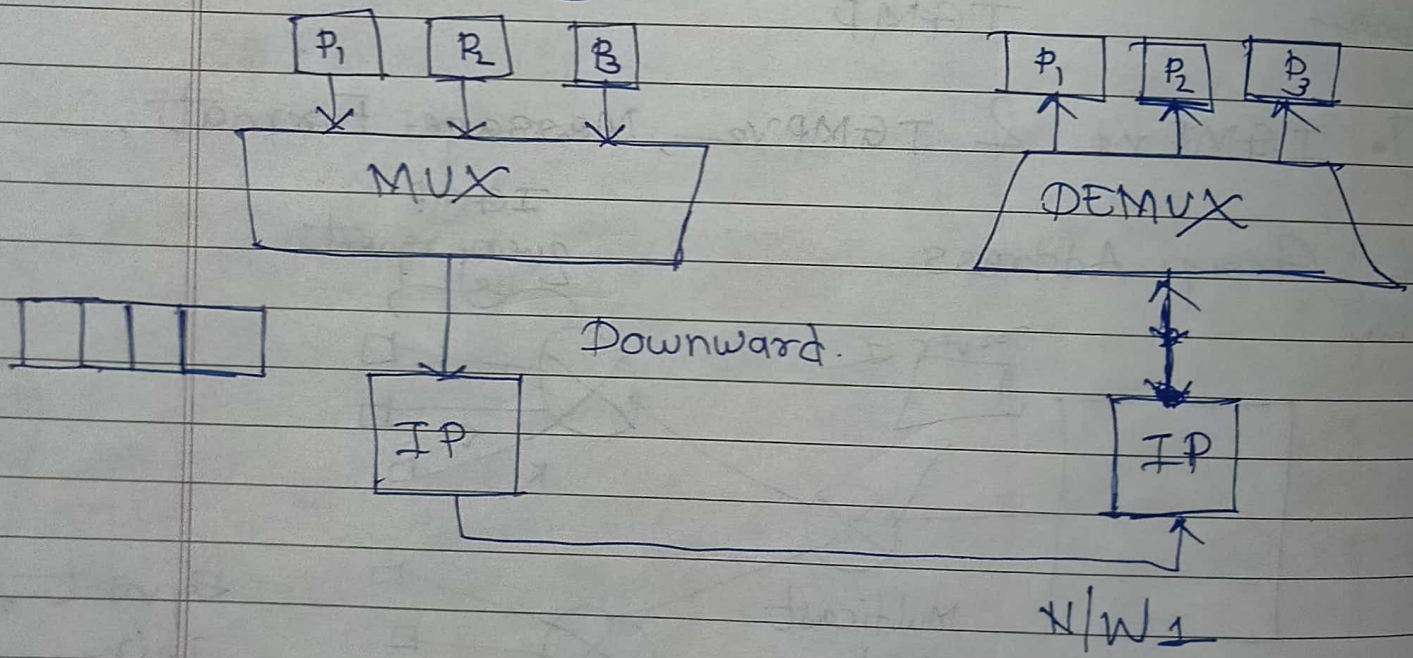
* Distance Vector Routing :
- Exchange information to neighbours.

Destination Vector Hop

17/10/2022
Monday

UNIT 4

Transport Layer Services.



robustness during catastrophe.

UNIT - 1

* Design Issues for Network Layer.

→

① Reliability : Data should be transferred to intended recievers.

Error correction / Error detection

Routing path algorithms for shortest path

② Evolution of Network :

- Addressing Mechanism
- Scalibity problems.
- Internetworking

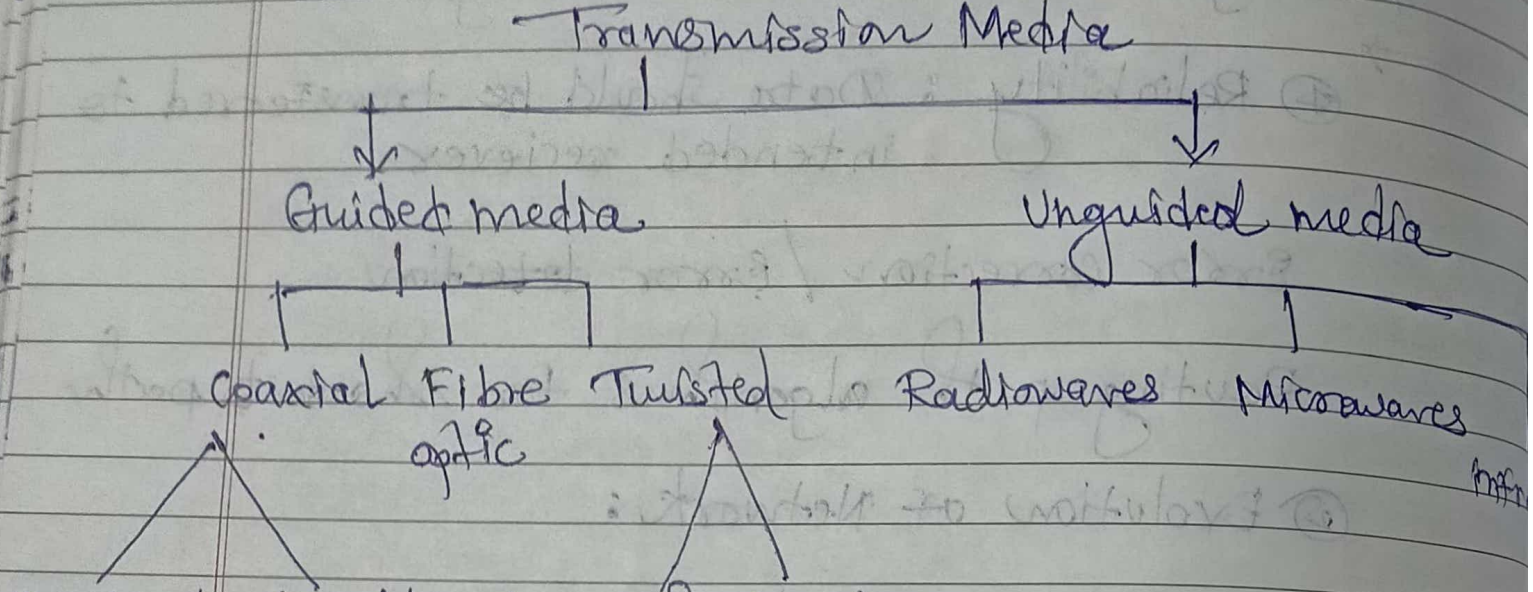
③ Resource Allocation :

- Bandwidth problem
- Statistical Multiplexing.
- Flow Control (efficient Communication)
- Congestion Control ; QoS.

④ Security Issues : Authentication

- Confidential information
- Integrity.

Types of Transmission Media:



(1) Twisted pair cable:

i. It is made up of twisted pair cable twisted with each other

ii. cheaper, frequency range 0 – 0.5 kHz.

- Unsheilded Twisted Pair: widely used
- Sheilded Twisted Pair: Higher transmission rate

(2) Coaxial Cable:

– As name suggests two parallly kept conductor Inner & outer - as copper & Copper mesh

Coaxial is of 2 types:

Baseband transmission: High speed transmission

Broadband transmission: multiple signal transmission.

③ Fibre Optic Cable:

- Used to send data by pulses of light.
- Faster data transmission than copper wires.

Unguided Media

① Radiowaves:

i. Can be transmitted in all directions of free space.

ii. range of frequency 3kHz to 1 kHz.

iii Radiowaves are Omnidirectional.

② Microwaves:

i. Microwaves are electromagnetic waves having frequency 1 GHz to 1000 GHz.

③ Infrared Waves:

i. Short range communication.

ii. 300 GHz to 400 THz.

eg. Cellphones, TV remote operations.

iii) High bandwidth & data rate will be very high.

Q. What is modem ?

→ Modulator - Demodulator is an electronic device that enables computers to transmit data over telephone lines.

A → D & D A

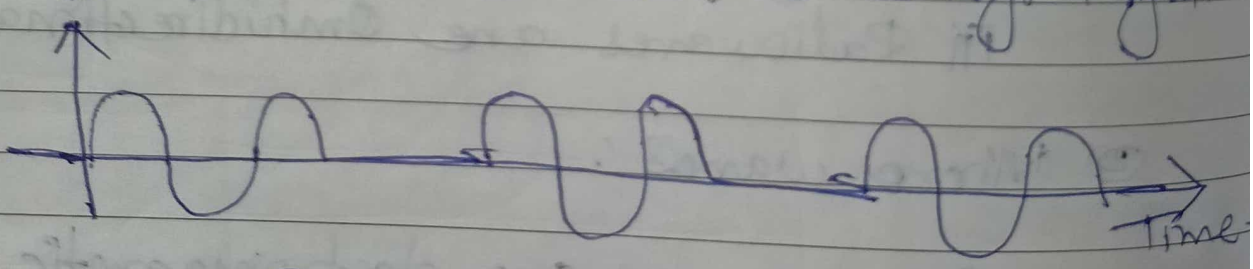
* Bandpass → pass frequencies through filter of interest.

Lowpass → passes low frequency signal.

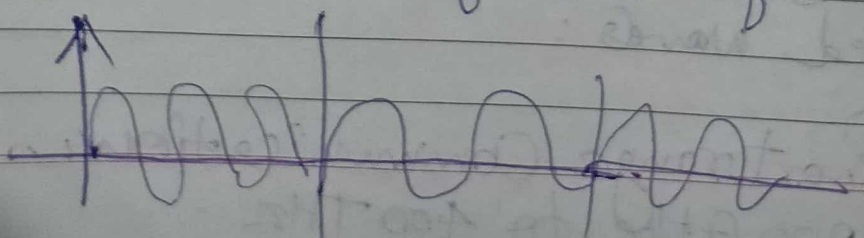
** Digital to Analog Communication.

① Amplitude shift keying : amplitude of carrier signal is modified to reflect binary data.

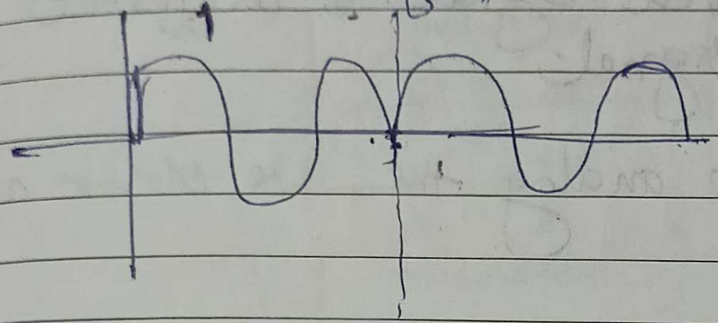
Freq & phase remains constant as original signal.



② Frequency shift keying : frequency of carrier signal is modified to reflect data.

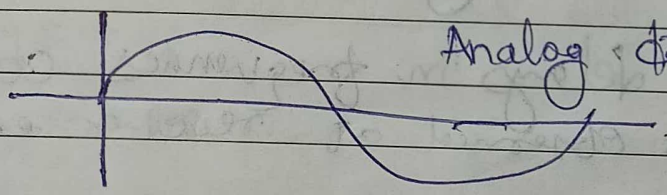


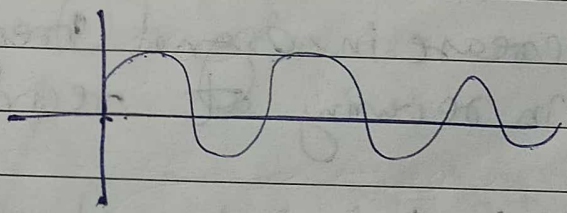
③ Phase Shift keying: In this phase of carrier signal is ~~altered~~ modified to reflect binary data.

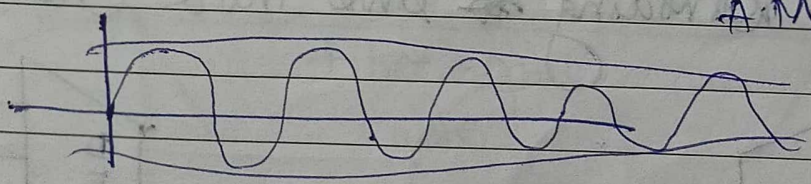


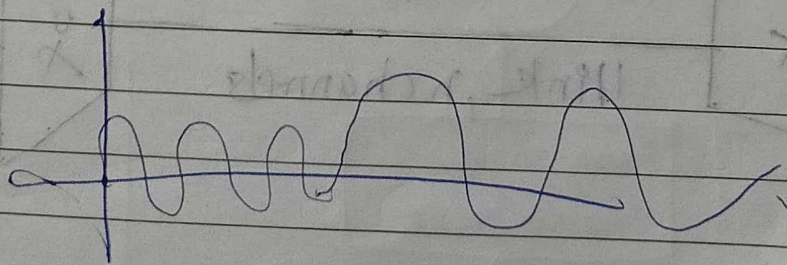
* A.M modulation:
In this modulation amplitude of carrier signal is modified to reflect ~~digital~~ analog data.

uses multiplier.









* Transmission Impairment:

When received signal is different from transmitted signal.

If sender sends analog the we observ amplitude change

If send sends digital, then we observe bits change

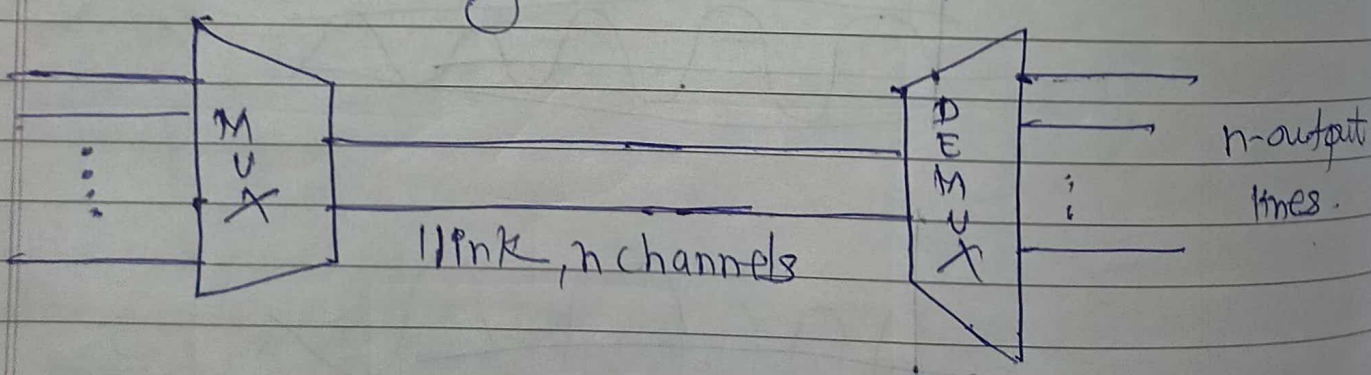
Causes:

(1) Noise: unwanted signal is causes distortion of transmitted signal is noise.

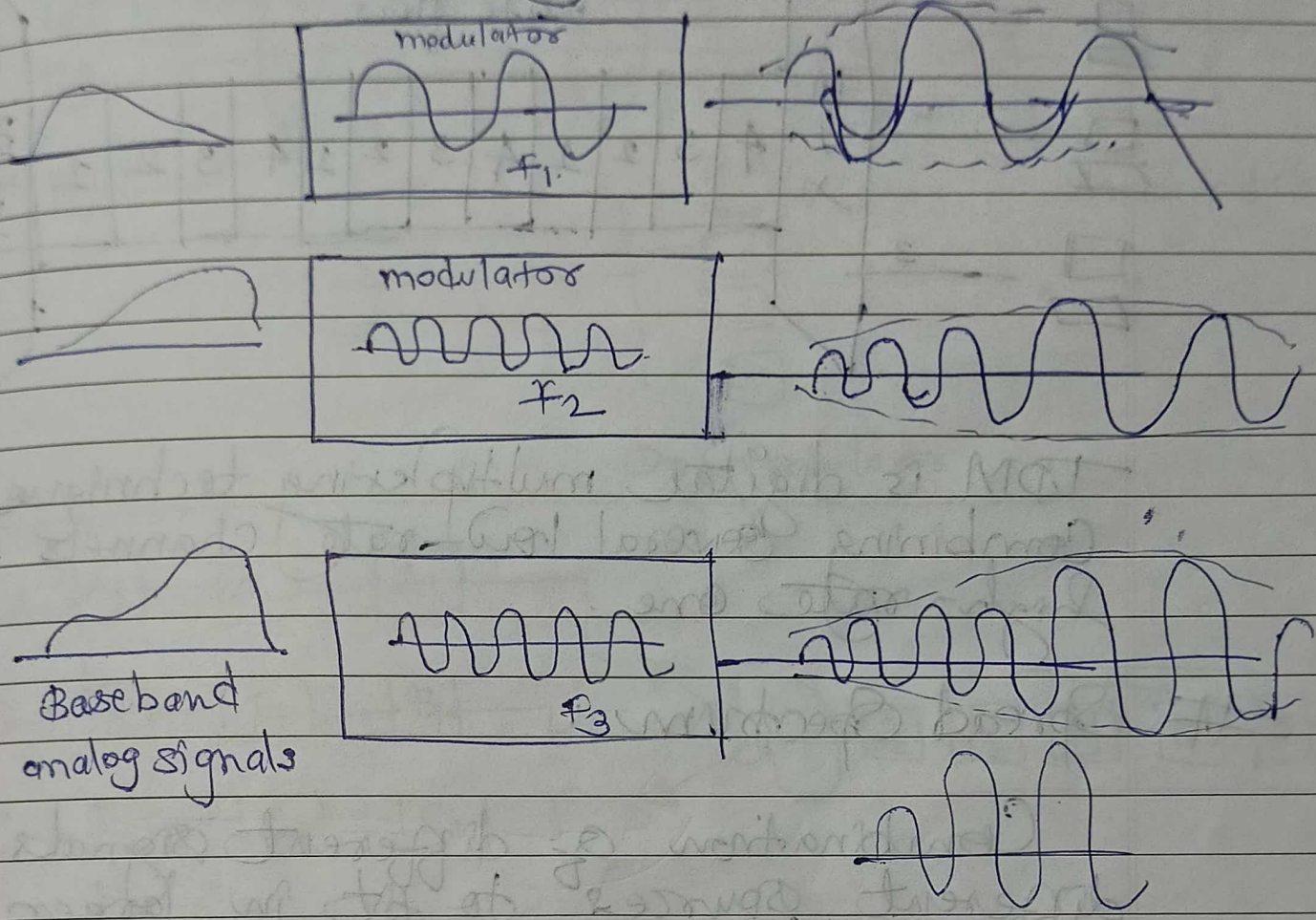
(2) Distortion: delays in frequencies component which will be observed at receiver end energy in sign

(3) Attenuation: Decrease in signal strength.
Difficulty in receiving at receivers end.

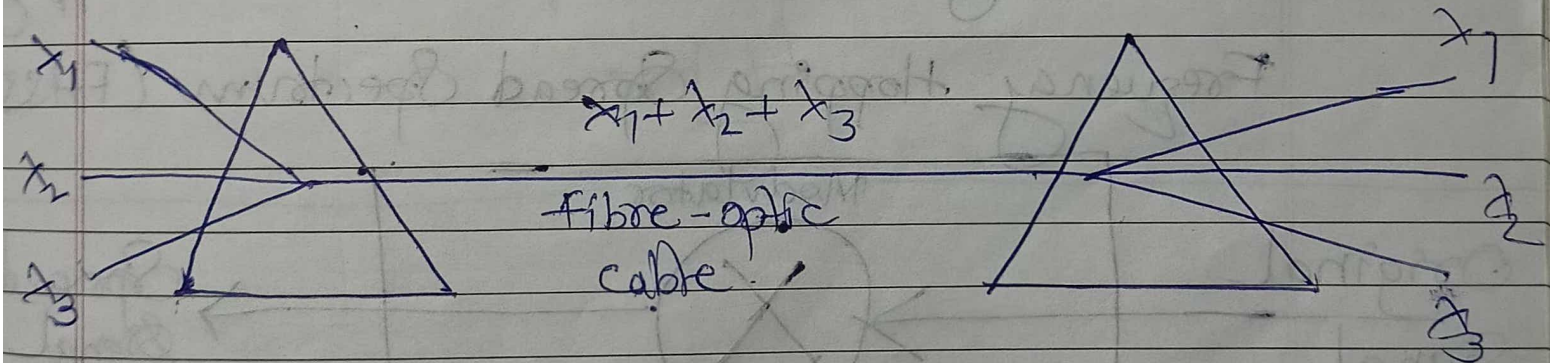
* MUX → Combining link into channels.



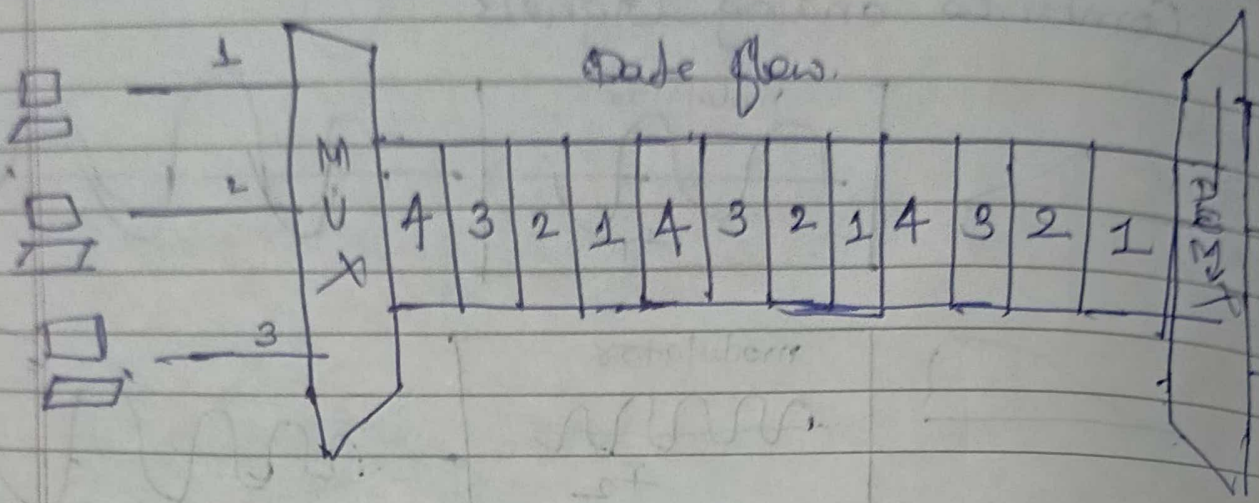
* FDM is an analog multiplexing technique that combines analog signals.



* WDM



* TDM

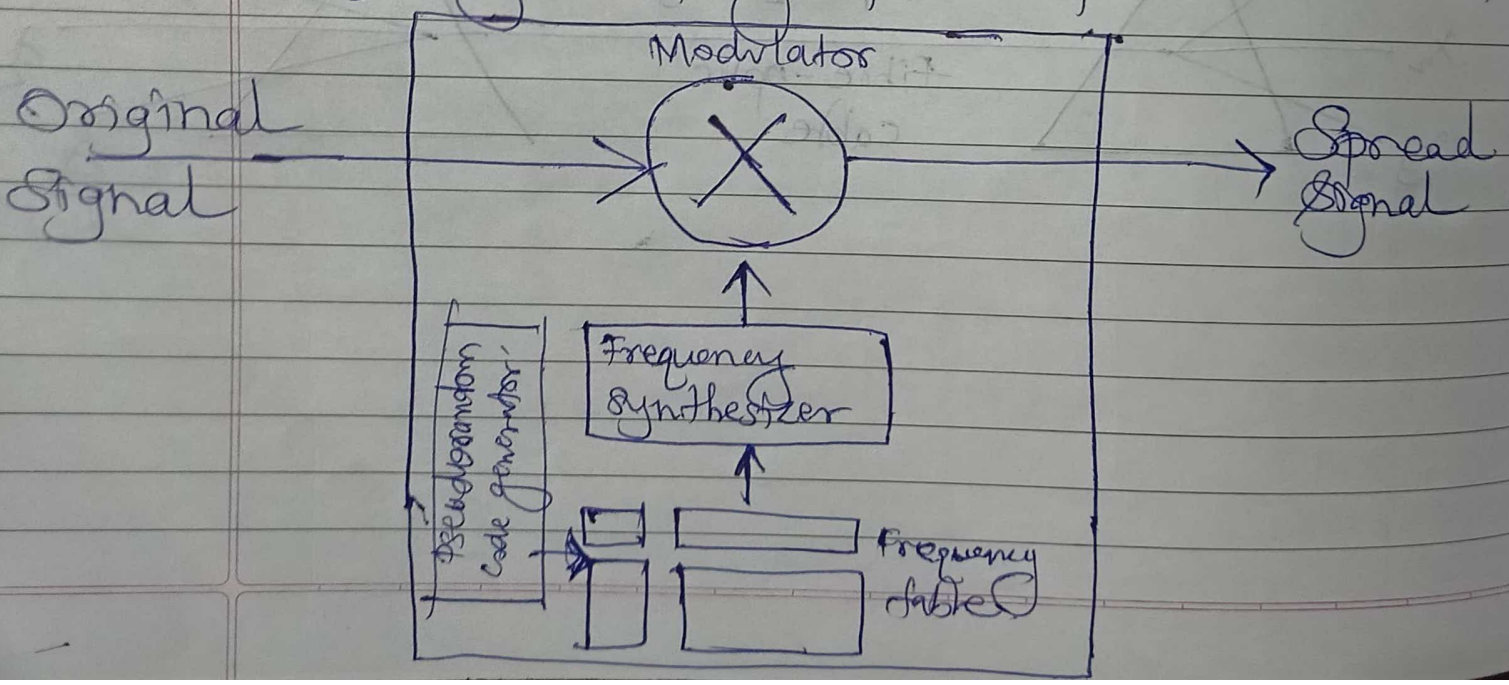


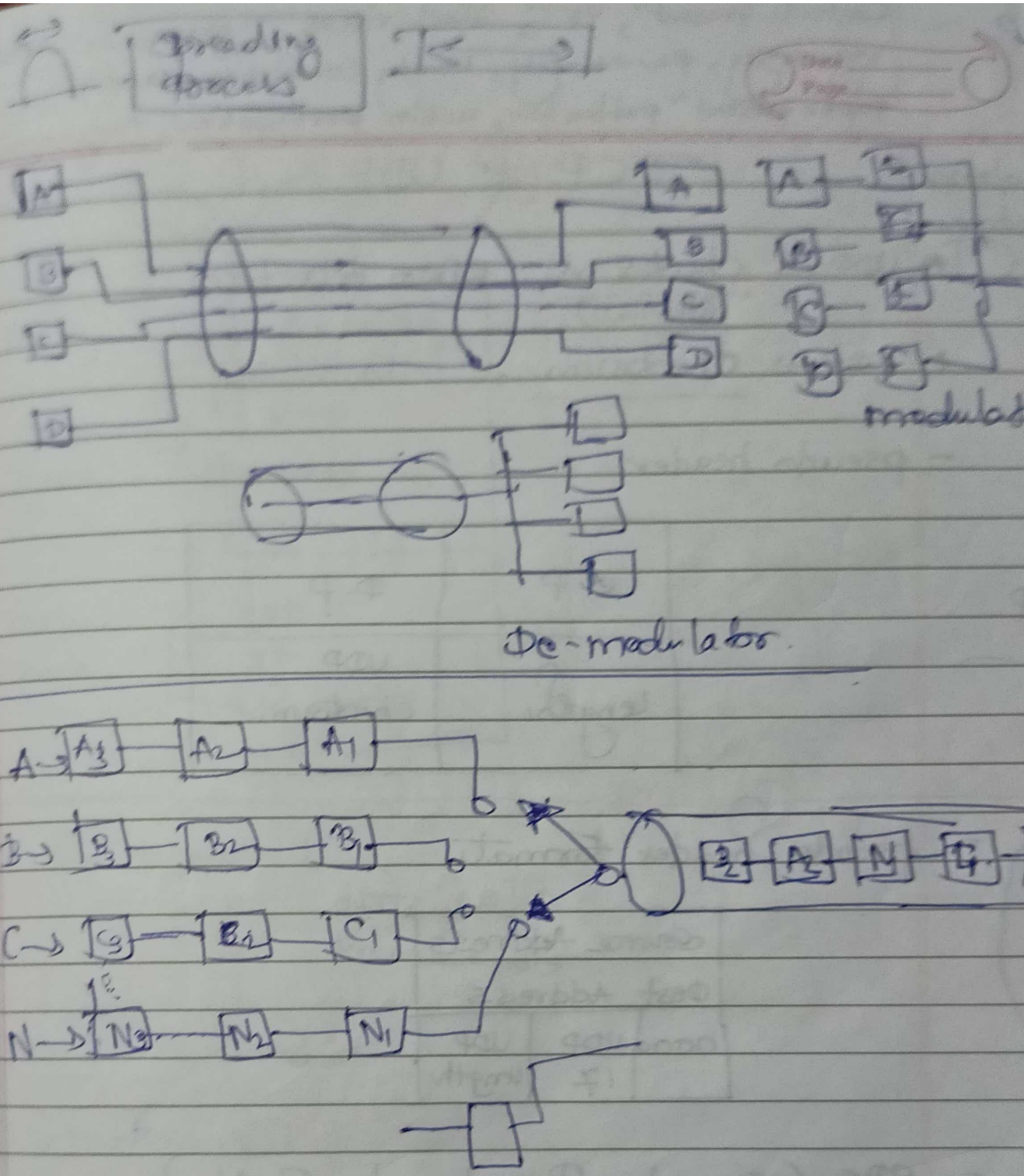
TDM is digital multiplexing technique for combining several low-rate channels into high-rate one.

Spread Spectrum :

Combination of different signals from different sources to fit in larger bandwidth but our goals are to prevent eavesdropping.

Frequency Hopping Spread Spectrum (FHSS).




Demodulator
De-modulator

regularity, punctuality, Timely Completion, reports, viva, paper present^N publication, active participation, Assignment

TCP & UDP

24/10/2022
Monday

- UDP → checksum, error detection
  (optional)
- TCP → Checksum,
  - pseudo header

TCP

S.P	D.P
Length	UDP checksum

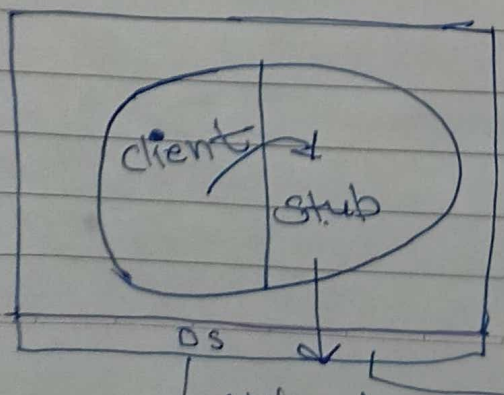
- pseudo header format

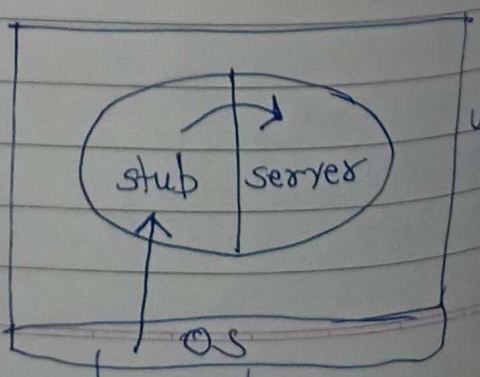
Source Address		
Dest Address		
0000	UDP 17	UDP Length

- RPC (Remote Procedural Call)
- Stub (Library)

Client

Server



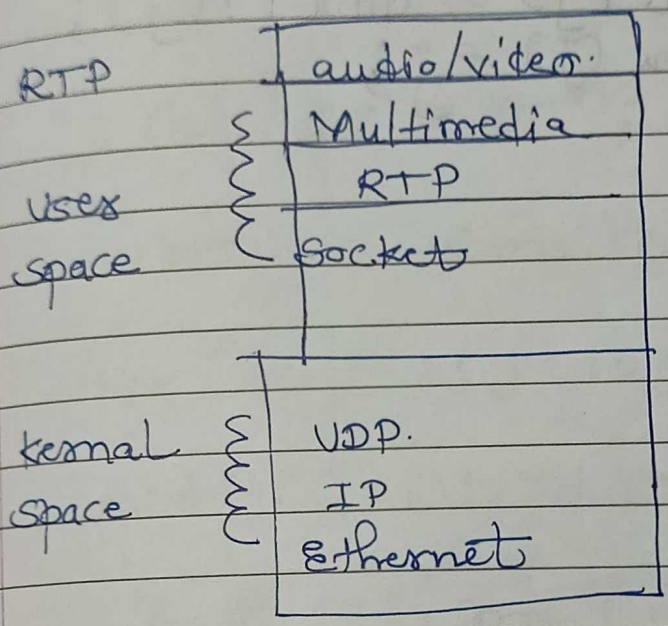


Marshalling

a = {1, 2, 3}
a = {

Date
Page

* Real Time Protocol (RTP)
multimedia data



11/2022
today

Struct node {
int dist [20];
int from [20];
};

route [10];

int main ()
{
int dm [20] [20], no;

Cout << "Enter no. of nodes" << endl;
Cin >> no;

Cout << "Enter the distance matrix" << endl;

for (int i = 0; i < no; i++)
{
Cin >> dm [i] [j];