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COMPUTER Network

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* LAN : Wired & Wireless LANs :-

▷ Ethernet is the most widely used LAN technology, which is defined under IEEE standard 802.3. The reason behind its wide usability is Ethernet is easy to understand, implement, maintain, and allows low-cost network implementation.

⊠ Wired LAN	⊠ Wireless LAN
○ wired LAN	○ wireless LAN.
• LAN N/W is a collection of computers or other such N/W devices in a particular location that are connected together by communication elements or N/W elements.	• WLAN N/W is a collection of computer or other such N/W devices in a particular location that are connected together wirelessly by comm. elements or N/W.
○ LAN is free from external attacks like interruption of signals, cyber criminal attacks and so on.	○ Where as, WLAN is vulnerable to external attacks.
○ LAN is secure	○ WLAN is Not secure
○ LAN N/W is Not popular.	○ WLAN is popular
○ Needs physical access like connecting the wires to the switches or routers	○ Work on connecting wires to the switches & router are neglected

Wired LAN	Wireless LAN
○ Devices are connected locally with ethernet cable	○ For WLAN Ethernet Cable is not necessary.
○ Mobility Limited	○ Outstanding Mobility.
○ It may or may not vary with external factors like environment & quality of cables.	○ It varies due to external factors like environment & quality of cables. Most of the external factor affects the signal transmission.
▷ LAN is less expensive	▷ WLAN is more expensive
Eg:- Computer LAB (office/school)	Eg:- Laptops, Mobile, etc.

Wireless LANs (WLAN):- are wireless n/w that use high-frequency radio waves instead of cables for connecting the devices with in the limited area forming (LAN).

Note** Most WLANs are based upon the standard IEEE 802.11 standard or wifi.

* Components OF WLANs:-

○ Stations:- comprises of all devices and equipment that are connected to wireless LAN. Each station has a wireless N/W interface controller. A station can be of two types:- ▫ client ▫ Wireless Access point (AP or WAP)

WLAN

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- Basic Service Set (BSS) – A basic service set is a group of stations (STA) communicating at the physical layer level. BSS can be of two categories –
  - Infrastructure BSS
  - Independent BSS.
- Extended Service set – It is a set of all connected BSS.
- Distribution System (DS) – It connects access points in ESS.

* Types of WLANS * –

① Infrastructure Mode ② Ad Hoc Mode

Advant:-
- Installation speed & simplicity
- Mobility.
- Installation flexibility
- Reliability
- Robustness
- Reduced cost of ownership.

Disadvant:-
- Lower bandwidth
- Less capacity
- Security for wireless LANs is the prime concern.
- Less capacity
- Wireless N/W cost four times more than wired N/W cards.
-

Characteristics:-
- Seamless operation
-
- Low power for battery use
- Simple Management, easy to use for everyone.
- Protection of investment in wired N/W.
- Robust Transmission technology.

Connecting LAN & Virtual LAN

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* **Requirements to set up "LAN" Networks -**
  - Workstation/Personal Devices - Laptop, Mobile.
  - Network Devices - router, switch, Modem.
  - Sharing resource - Printers, disk drives etc.
  - Cables - Ethernet cables, wires for connecting Devices.
  - Internet connection : wi-fi (in case of wireless)

* **Instruction to set up LAN N/W :-**

1. Identify services
2. Identify Devices
3. Plan connections
4. Select N/W devices
5. Configure ports
6. Make connections
7. Test the Network.

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Virtual LAN : — (Logically Division or Grouping in Sw
(VLAN)

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▷ It is a concept in which we can divid the devices logically on layer 2 (Data-link l
- Generally, layer 3 devices divide broadcast domain but broadcast domain can be divided by switches using the concept of VLAN

* VLAN ranges :-

- VLAN 0, 4095 :- These are reserved VLAN which cannot be seen or used.
- VLAN 1, - It is the default VLAN of switches. By default, all switch ports are in VLAN. This VLAN can't be deleted or edit but can be used.
- VLAN 2-1001 :- This is a normal VLAN range. We can create, edit and delete these VLAN.
- VLAN 1002 - 1005 :- These are CISCO defaults for Fddi and token rings. These VLAN can't be deleted.
- VLAN 1006 - 4094 : -This is the extended rangl of VLAN.

Ex:- A NLAN allow 'two' LAN n/w PCs to be seperated although they share same infrastructure.

▷ Physical Dono LAN same switch se connect honge but work seperatly karenge.

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* When do I need a VLAN?

1. You have more than 200 devices on your LAN
2. You have a lot of broadcast traffic on your LAN.
3. Or, just to make a single switch into multiple
4. Group of users need more virtual switches. security or are being slowed down by too many broadcasts?

* Three types of connection in VLAN:-

1. Trunk Link – All connected devices to a trunk link must be VLAN aware. All frames on this should have a specid Reader attached to it called tagged
2. Access link :- It connects VLAN - Unaware devices to a VLAN - aware bridge. All frames on the access link must be untagged
3. Hybrid link :- It is combination of the trunk & Access link. Here both VLAN - Unaware & VLAN - aware devices are attached & it can have both tagged & untagged

ADVANTAGE :- (1) performance (2) Formation of virtual groups.
(4) security (5) flexibility
(6) cost reduction.

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LAN & VLAN

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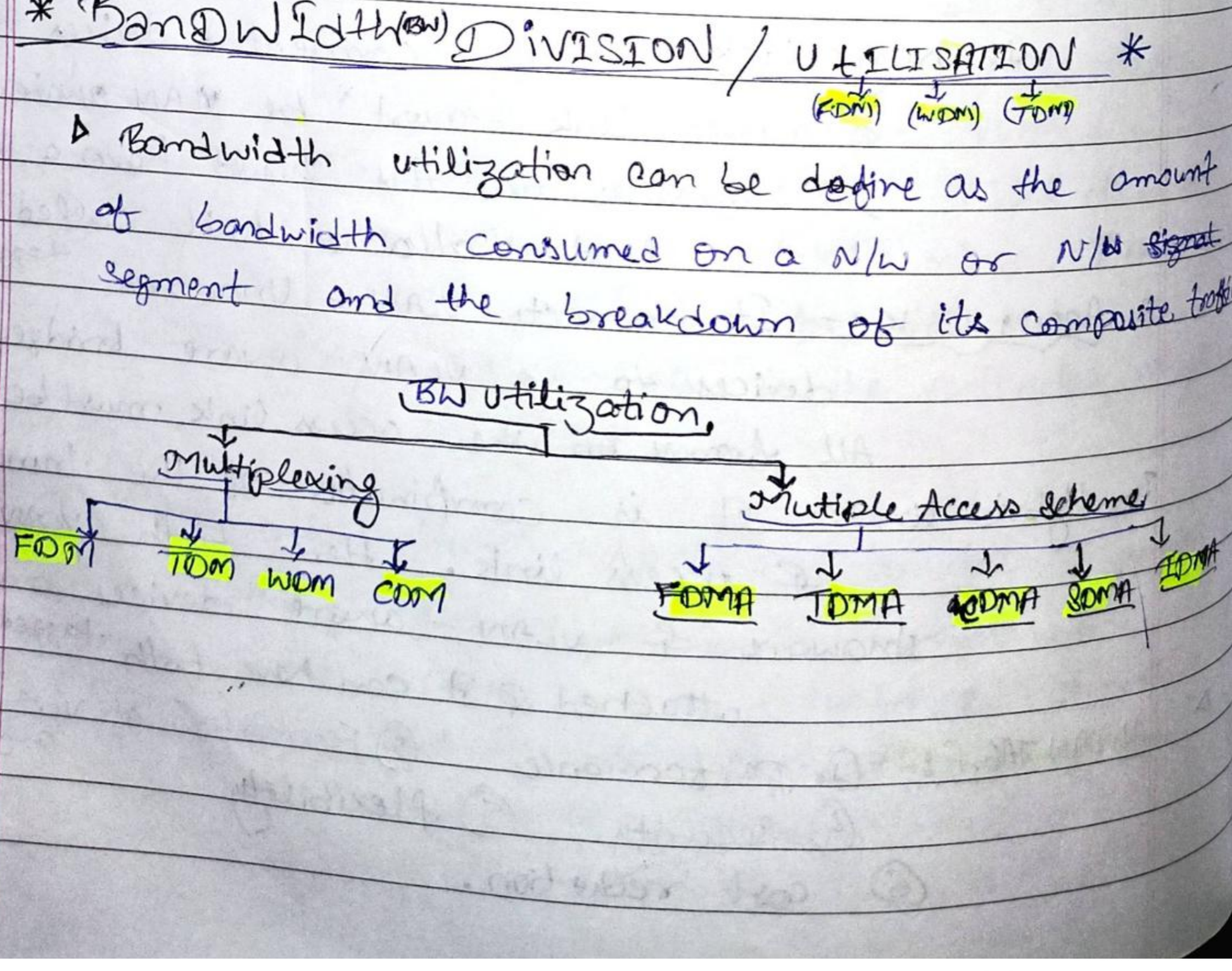
LAN	VLAN
> All configuration only done in PC.	> Configuration done in both PC and the switches.
> In LAN we cannot configure ports available in a switch.	> VLAN allows you to configure each & every ~~point~~ port available in a switch.
> Router is required to communicate b/w two different network.	> Even without Router two or more virtual N/ws can communicate. All the configuration done in the switch's left
> Hence all the Data travels in the same broadcast domain, the N/w traffic is more	> Each VLAN their own broadcast domain, Hence the N/w traffic is low.
> N/w cost is high	> Network cost is low
> Network construction is simple.	> Network construction is complex.

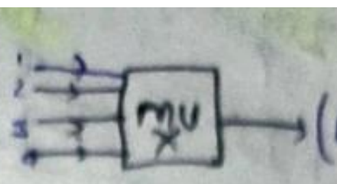
* BandWidth(BW) DIVISION / UTILISATION *

(FDM) (WDM) (TDM)

▲ Bandwidth utilization can be define as the amount of bandwidth consumed on a N/w or N/w segment and the breakdown of its composite traffic



Multiplexer



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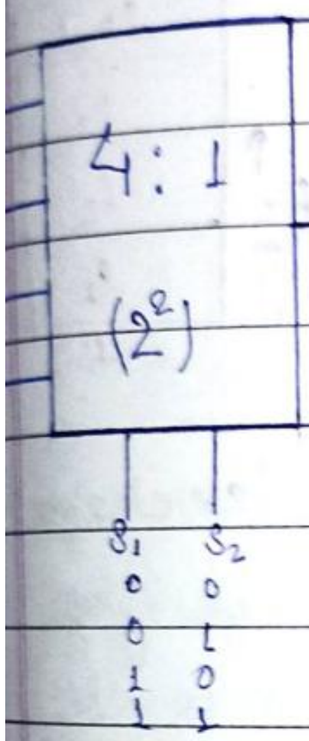
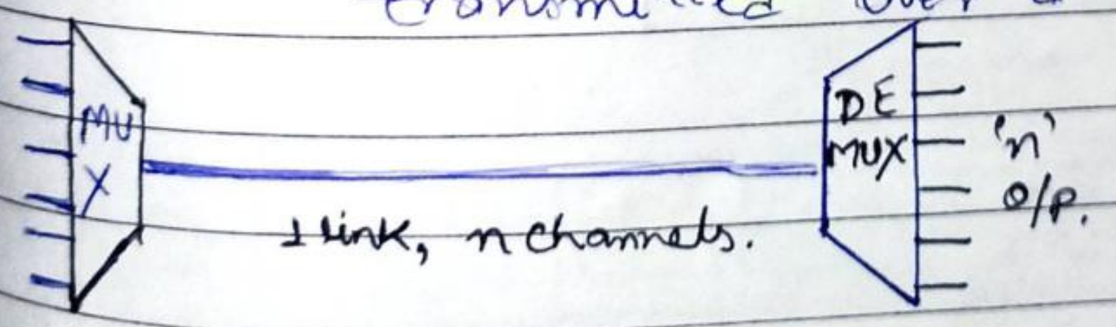
A multiplexer is a combination circuit has '2^n' input lines & a single o/p line.

It also called electronic switch that connets 1 out of 'n' inputs to an output.



$$Y = (S_1' S_0' I_0 + S_1' S_0 I_1 + S_1 S_0' I_2 + S_1 S_0 I_3)$$

Multiplexing :- It is the sharing a medium or bandwidth. It is the process in which multiple signals coming from multiple sources are ~~connected~~ combined & transmitted over a single communication/ Physical line.



Types OF Multiplexing :-

1. FDM
2. TDM
3. WDM.

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2nd Given 1st Given

TDM FDM WDM

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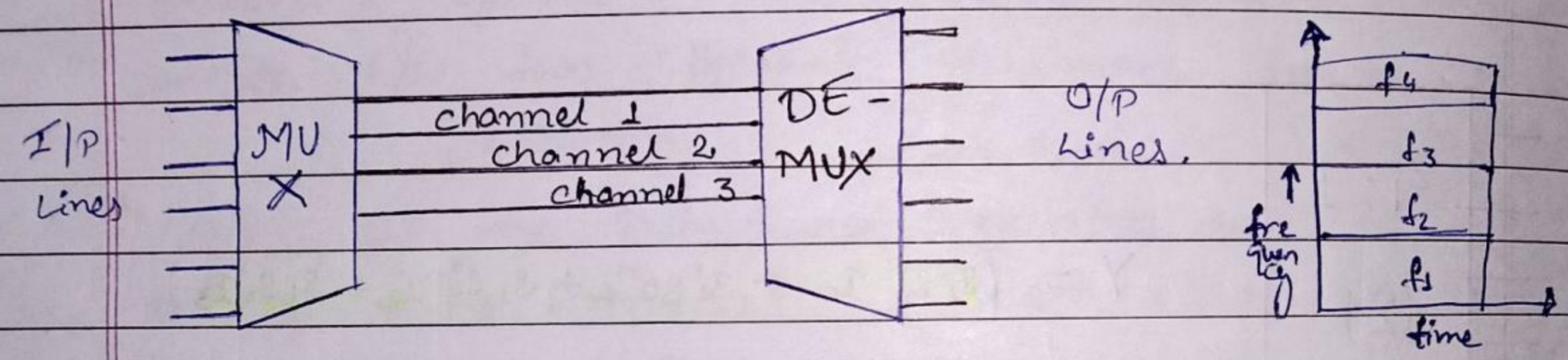
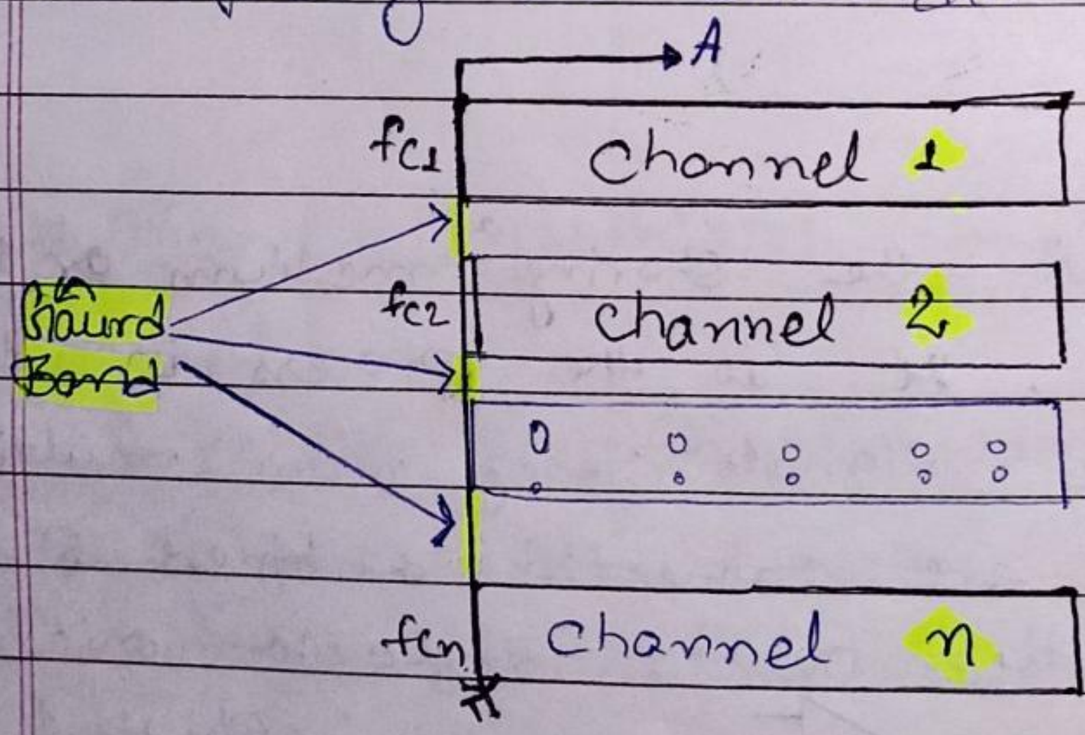
Analog.

① FDM :- Frequency Division Multiplexing is a type of multiplexing where the bandwidth of a single physical medium is divided into a Number of smaller, independent frequency channels.

Ex:- Radio, T.V



o In FDM, we can observe a lot of inter channel cross-talk, due to the fact that in this type of multiplexing the bandwidth is divided into frequency channels.



digital.

② TDM :- Time division Multiplexing is a type multiplexing wherein, Time is shared (same as FDM but there is Bandwidth sharing) In TDM, all signals operate with the same frequency (bandwidth) at different time.

Guard
* No Guard Band
* Radio System.

WTDM

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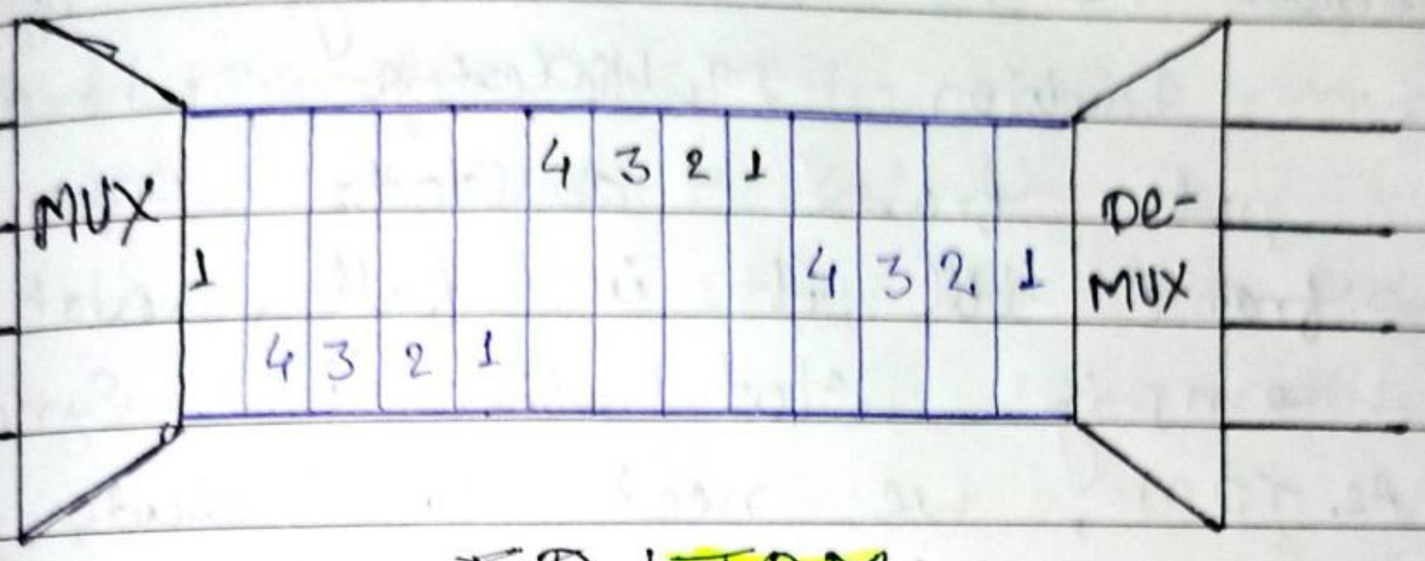
Eg :- TDM :- (GSM), (GPRS), (EDGE)

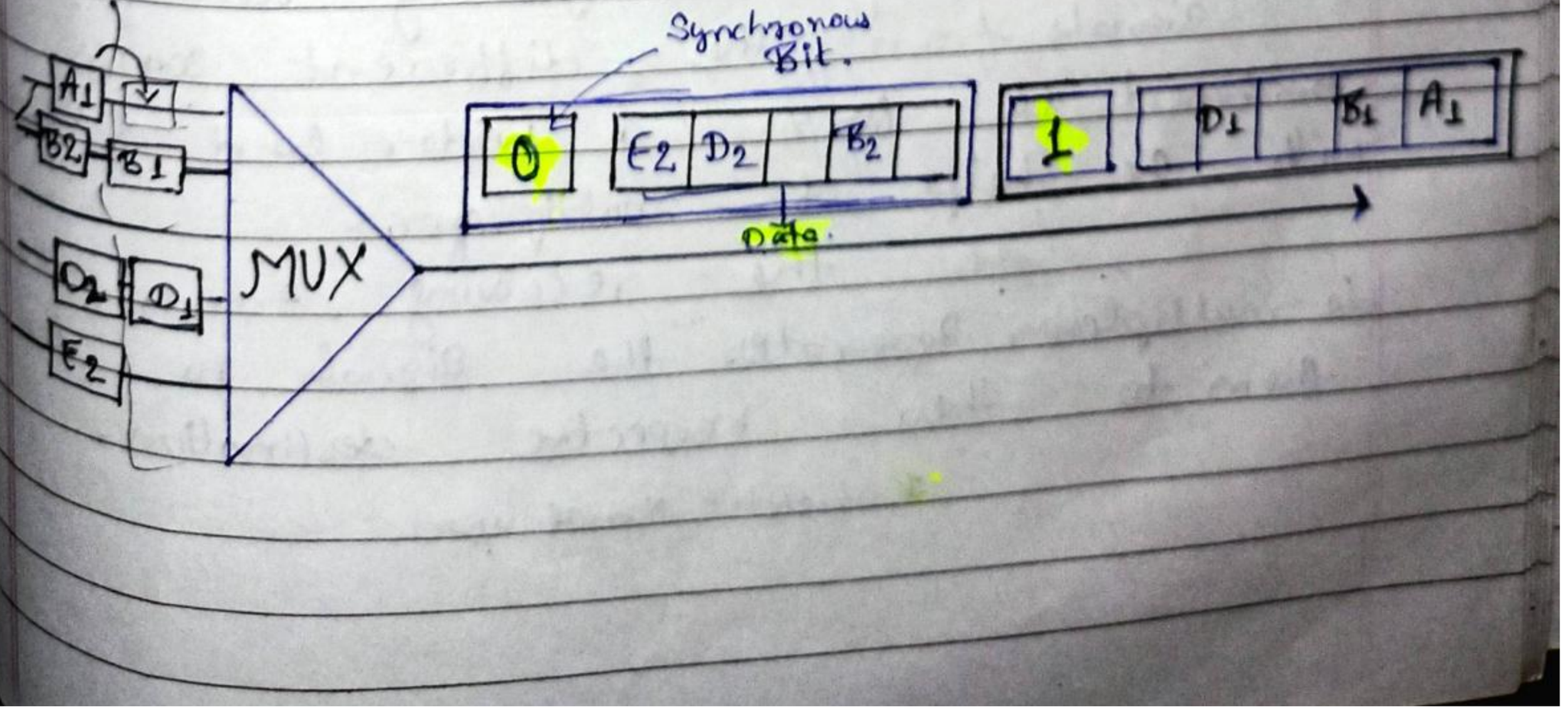


~~FD~~ [TDM]

There are two types OF TDM :-

1. Synchronous TDM
2. Asynchronous TDM (Statical).

- S. TDM is a type OF TDM where the input frame already has a slot in the output frame. Time slots are grouped into frames. One frame consists of one cycle of ~~th~~ time slots.
- S. TDM is not efficient because if the input frame has no data to send, a slot remains empty in the output frame.
- Also need to mention the Synchronous bit at the begining of each frame.



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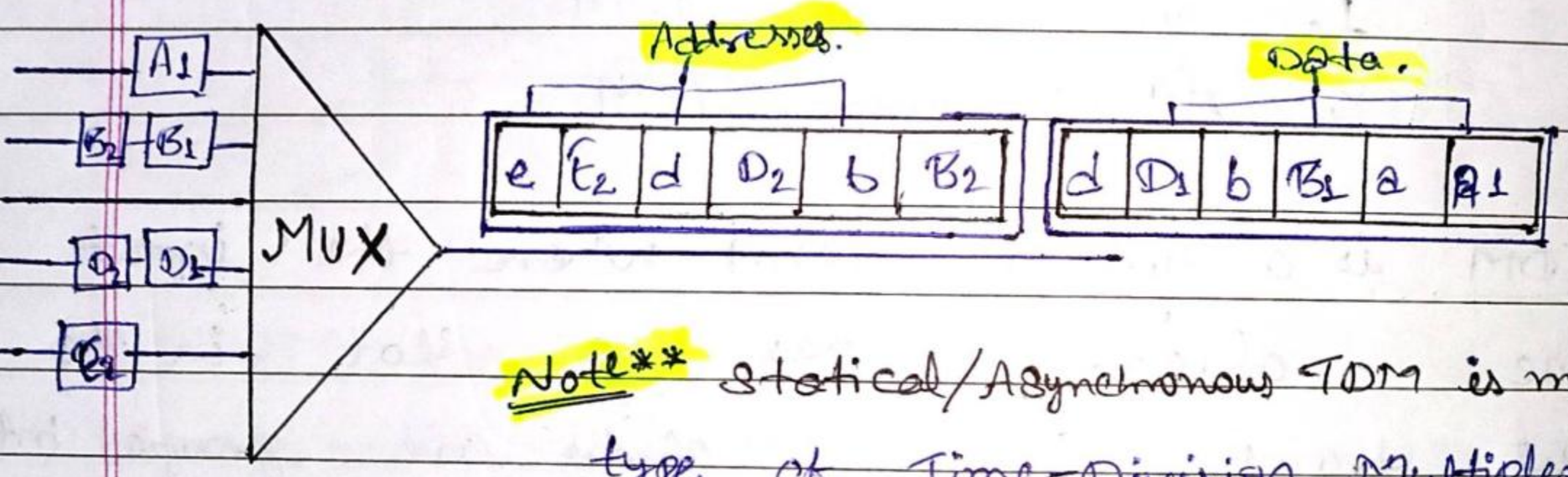
2. Statistical TDM :- is a type of Time Division Multiplexing where the output frame collects Data from input frame till it is full, Not leaving an empty slot like in Synchronous TDM.

▷ In As. TDM, we need to include the addr of each particular data in the slot that being sent to the 'Output frame'.



Note** Statical/Asynchronous TDM is more efficient type of Time-Division Multiplexing as the channel capacity is fully utilized & improves the bandwidth efficiency.

Analog

(3) WDM :- Wavelength Division Multiplexing :- is used on fiber optics to increase the capacity of a single fiber. It is an analog multiplexing technique. Optical Signals from the different source are combined to form a wider band of light with the help of multiplexers.

At the receiving end, the de-multiplexer operates the signals to transmit them to their respective destination.

* Light-signal used.

WDM

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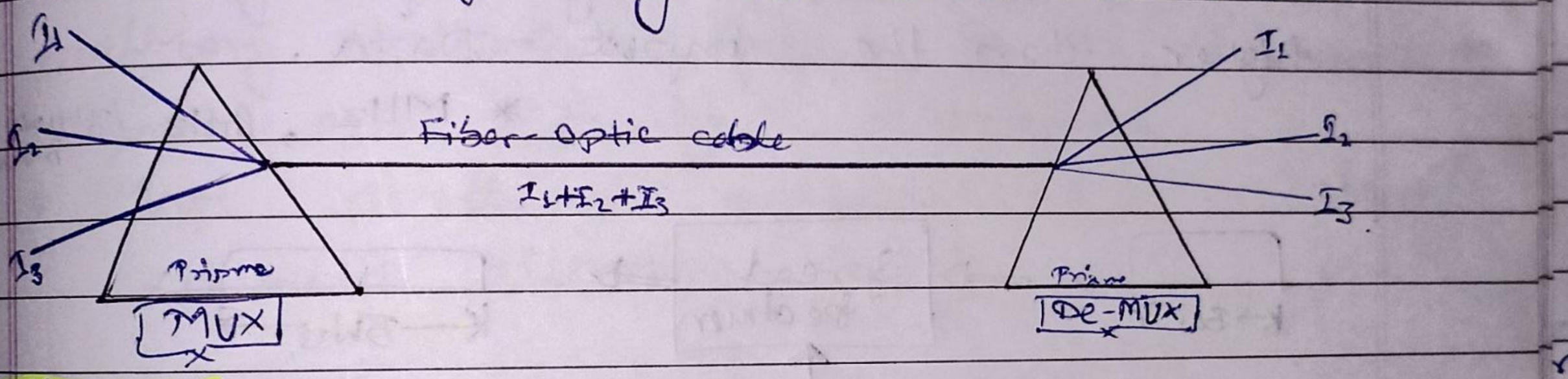
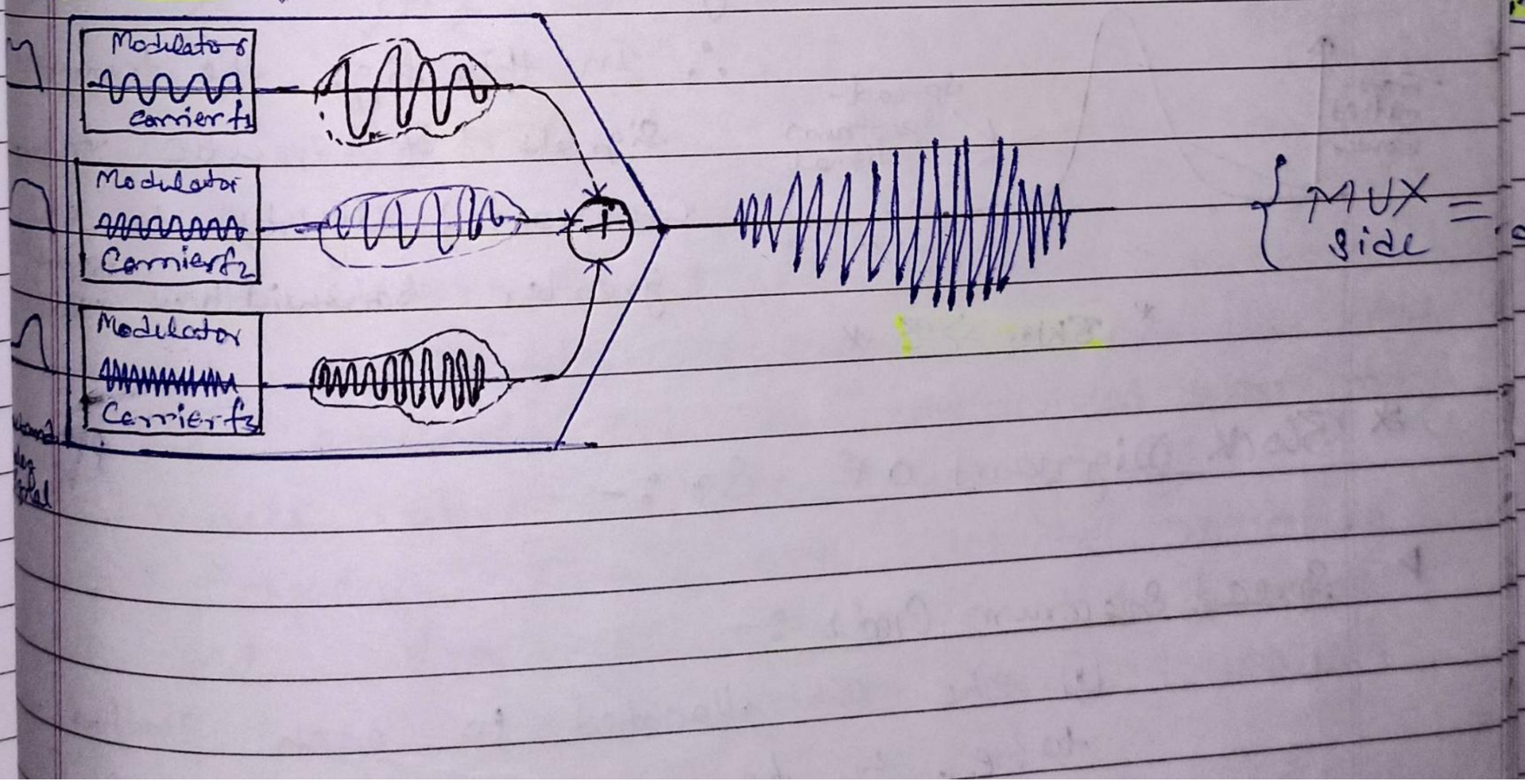
** WDM is same as FDM except that the optical signals are transmitted through the fiber 'optic cable'

⇒ It designed to utilize the high data rate capability of fiber-optic cable..



*FDM Process :-



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Concept of Spread Spectrum

↳ Wireless Technique.

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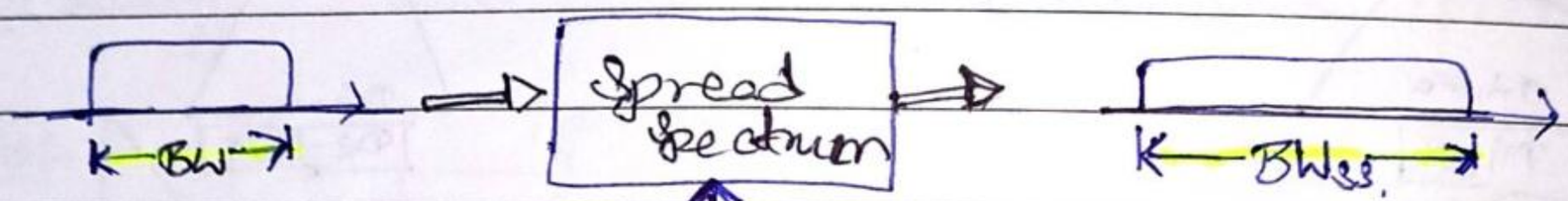
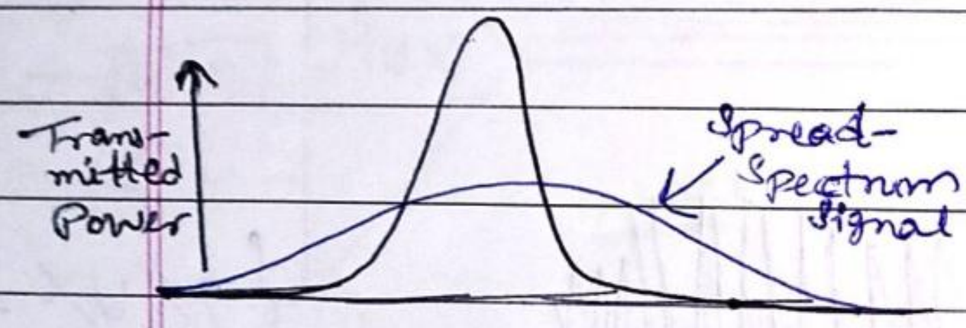
▷ It is a Modulation Technique in which transmitted Bandwidth is longer than information signal Bandwidth (BW).

** Bit rate spreading sequence is much higher than the input Data.

* MHz, GHz (It used eg:- in Radio Network)





∴ In this fig., the transmitted signals of specific frequencies are varied slightly to obtain greater bandwidth as compare to Initial (BW)

* BWss >> B *

* Block Digram of SS :-

▷ Spread Spectrum Goals :-

(1) The BW allocated to each station need to be, by far, larger than what is needed. This allow redundancy.

(2) The expanding of the original BW (Bandwidth) to the bandwidth (Bss) must be done by a process that is independent of the original signal. [or] The spreading process occurs after the signal is created by the source.

Reason to Use SS

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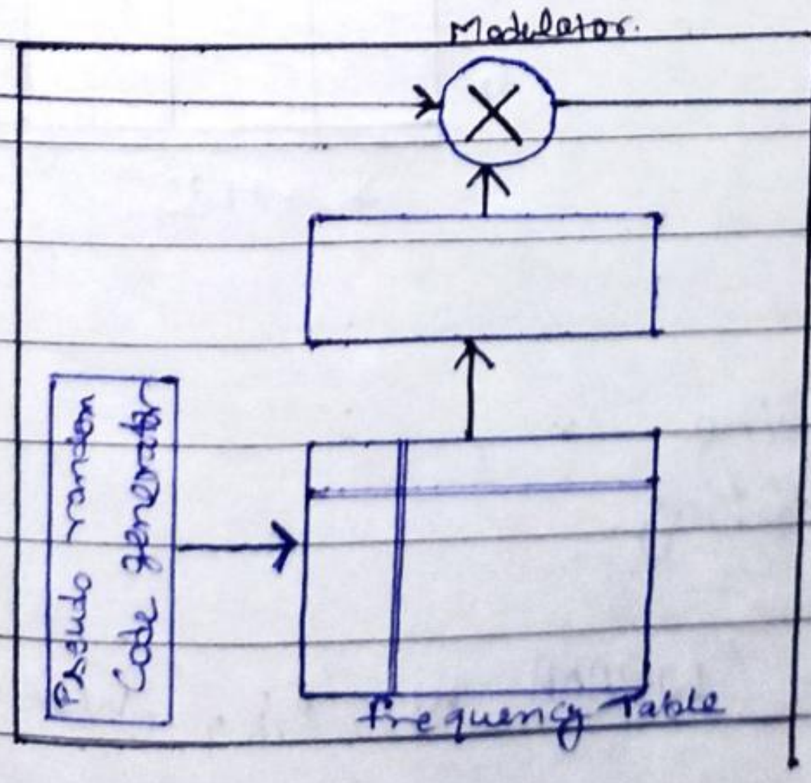
- SS signals are distributed over a wide range of frequencies and then collected & received back to the receiver. (wide-Band signals are noise like & challenging to detect)
- Initially, the Spread S. was dopp adopted in military applications because of its resistance to jamming and difficulty intercepting.
- Most preffered due because of its useful bandwidth utilization ability.

* Types of Spread Spectrum *

1). FHSS
2). DSSS

1. Frequency Hopping SS or FHSS allows us to utilize Bandwidth properly & maximum, the whole available BW is ~~div~~ divided into many channels arranged continuously.
   - Frequency slots are selected randomly, and frequency signals are transmitted according to their occupancy.

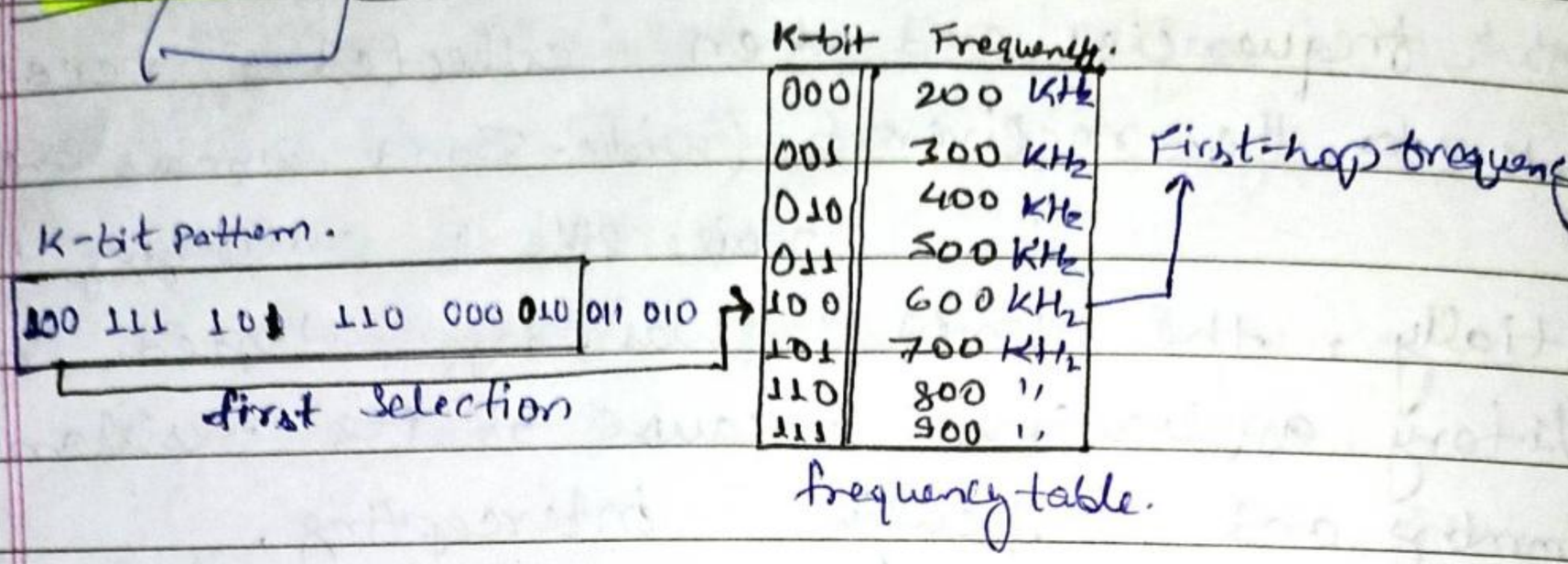


Fig

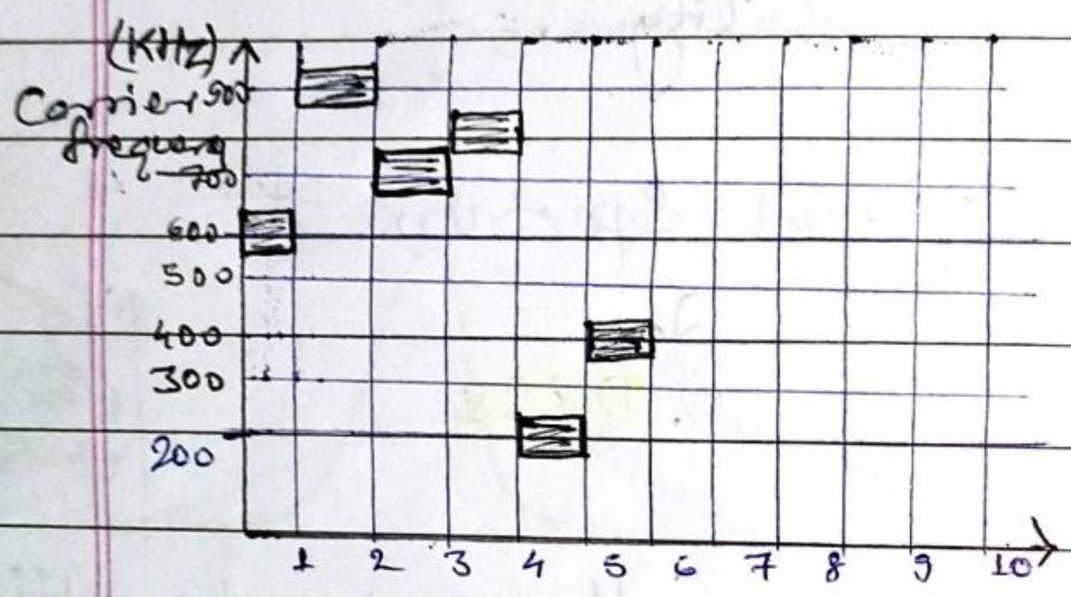
So, the pseudo-random code generator will create different 3-bit pattern

Eg:- 000, 001, 010, 011, 100, 101, 110, 111

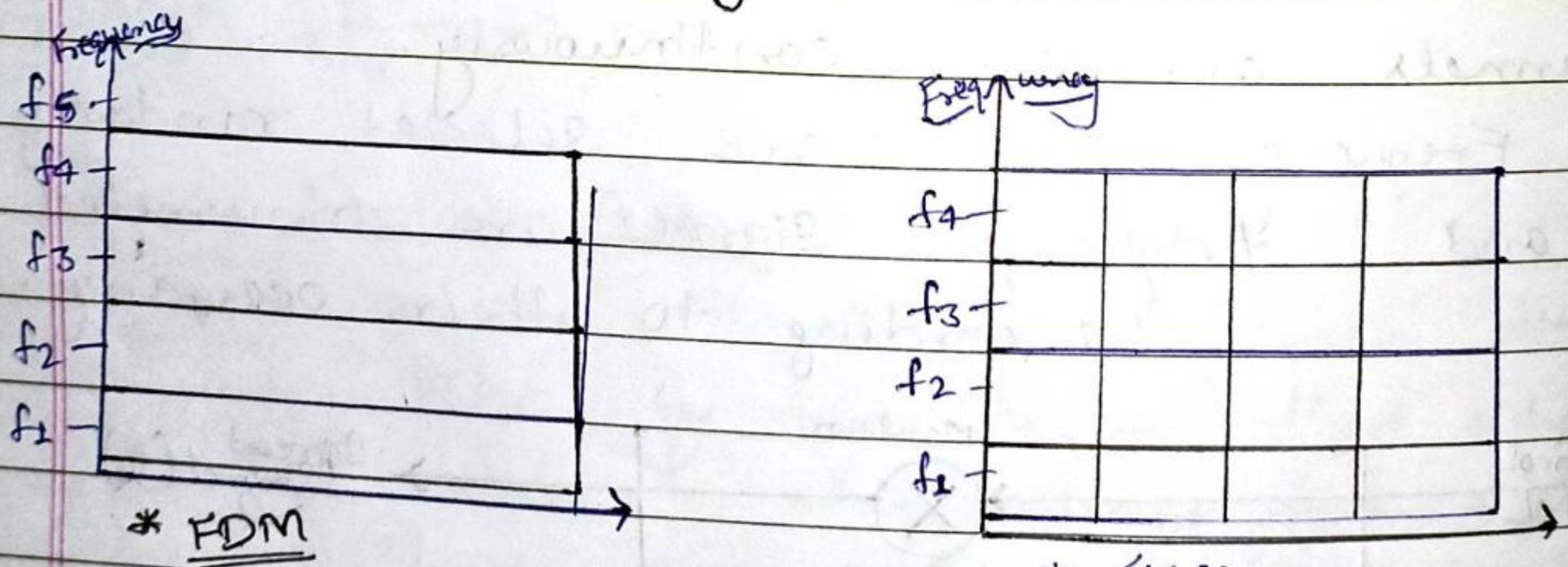
Frequency Selection in FHSS :-



FHSS Cycles :-



* Bandwidth Sharing :-



- FHSS
  - * Slow Hopping.
  - * Fast - Hopping.

* Application of FHSS :- (WPAN), Wi-Fi, (WLAN).

DSSS

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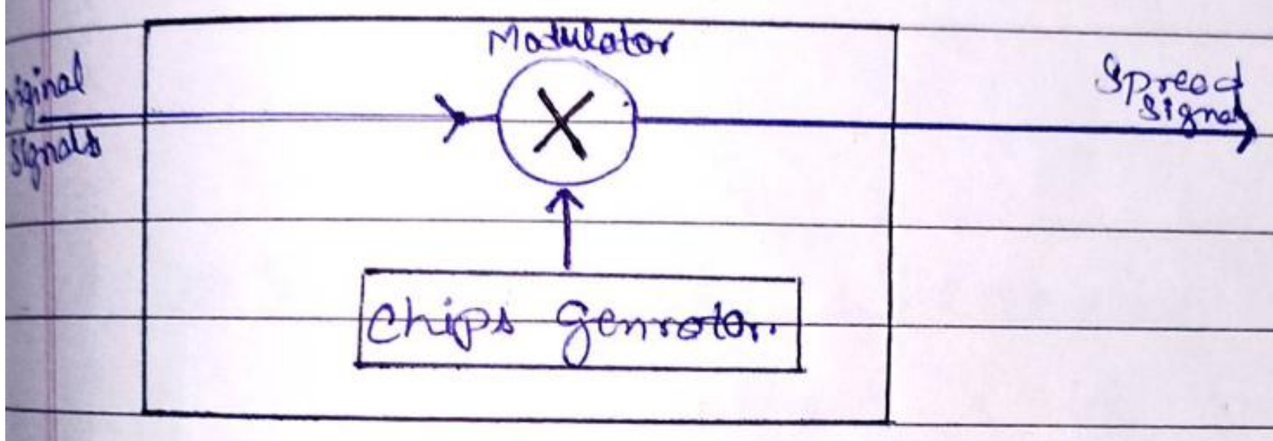
Direct Sequence - Spread Spectrum technique also expands the bandwidth(BW) of the original signal, but the process is different. In DSSS, we replace each each data bit with 'n' bits using a spreading code.

- Each bit assigned a code of n bits called chips, where the chips rate is n times that of the Data bit.



- As an example, Lets consider in Wireless LAN, the famous 'Barker Sequence' where 'n' is 11. We assume that - 'original signal' & chips generator use polar 'NRZ encoding'.