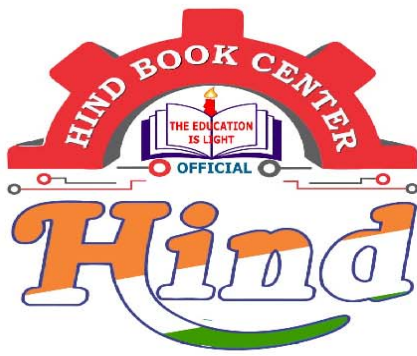




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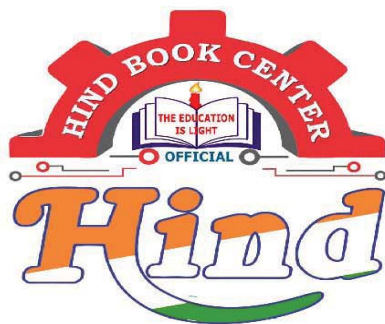
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Syllabus :

- 30 ① Optical communication^(ofc)
- 20 ② Cellular communication^(Hybrid)
- 1-20 ③ Satellite communication^(wireless)
- 20 ④ Microwave communication^(wireless)
- ① GSM ② CDMA
- MHz/GHz
- ① Wave propagation
- ② Microwave Antenna
- ③ RADAR

- 50 ⑤ Data Communication.
- ① OSI/ISO - 7 layer
- ② TCP/IP - 5/4 layer
- ③

In Commⁿ

- C(t)
- Sinusoidal
- MHz

Channels

- Copper } commⁿ
- co-axial }
- waveguide
- ofc
- Power lines

Weightage :

- ① Prelims → 12-16 Que
- ② Main → 80-100 Marks

Textbook :

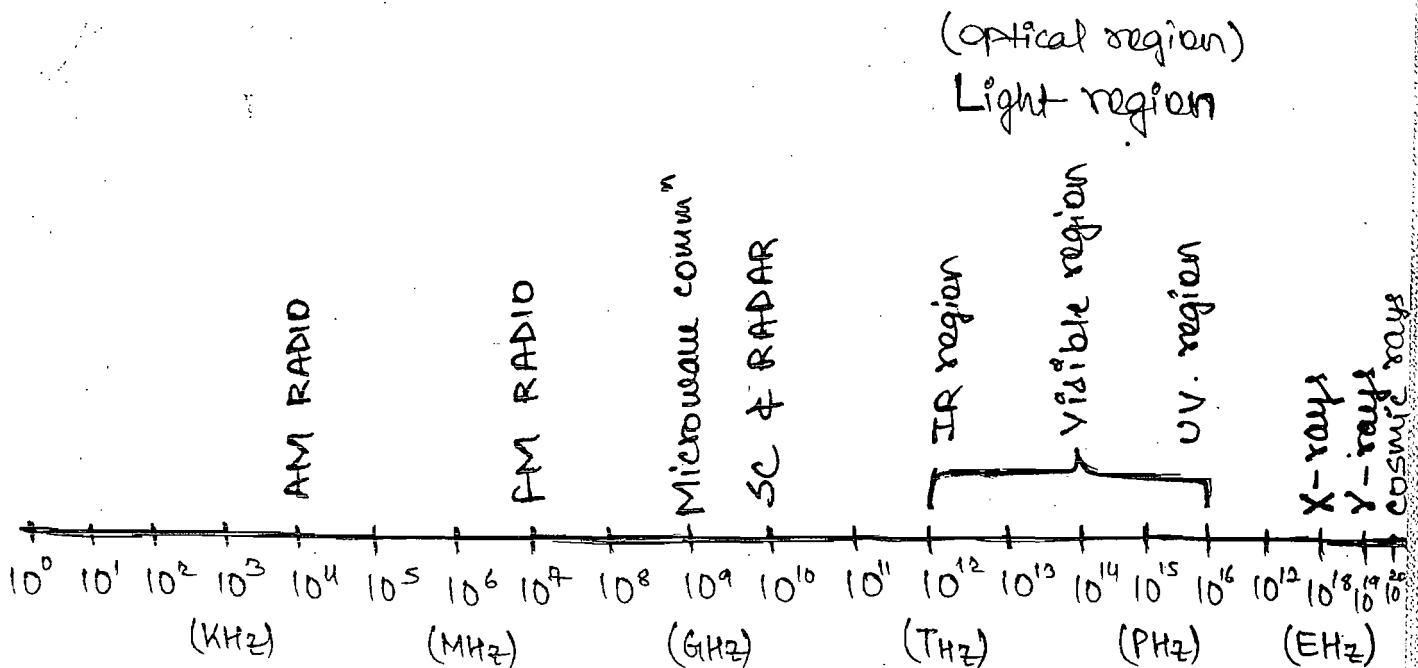
- Optical commⁿ - Senior
- Satellite " - Pratt
- Cellular " - Rapoport
- Data Comm - Foruzan



Optical Communication

INTRODUCTION -

Electromagnetic Spectrum :



$$\boxed{\lambda = \frac{c}{f}}$$

#

BUR :- Bandwidth utilization Ratio

$$BUR = 10\% \text{ of } f_c$$

Case ①

$$f_c = 100 \text{ KHz}$$

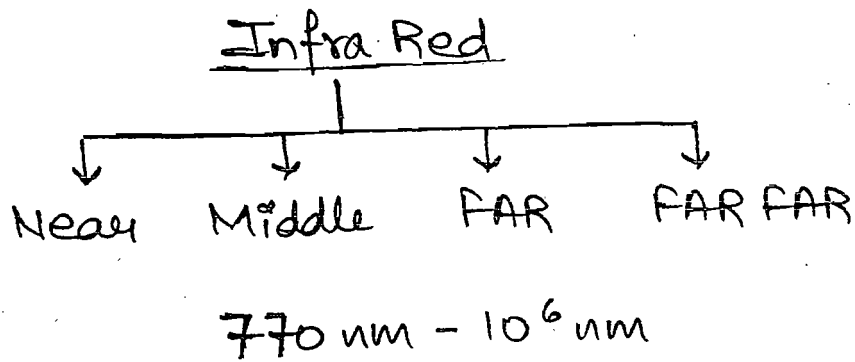
$$BUR = \frac{10}{100} \times 100 \text{ K} = \underline{10 \text{ KHz}}$$

Case ②

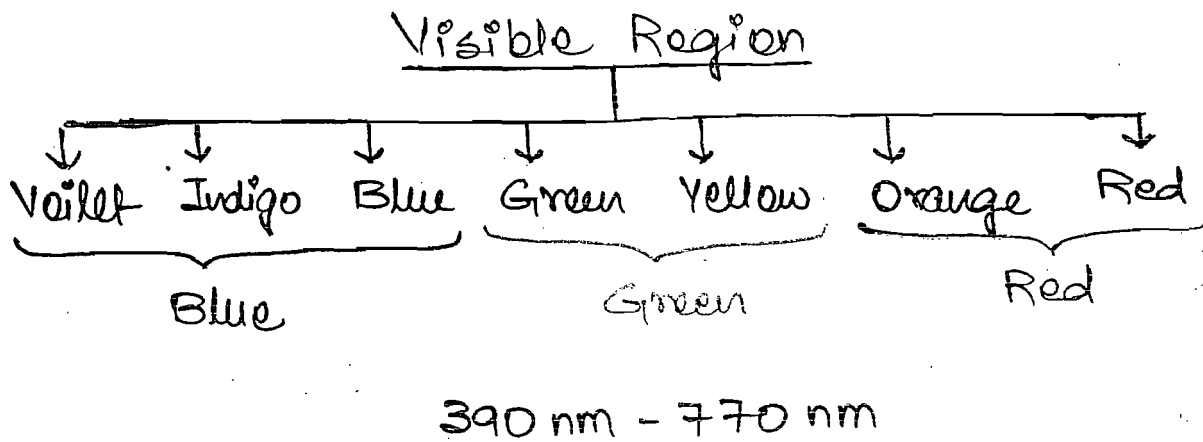
$$f_c = 100 \text{ THz}$$

$$BUR = 100 \text{ T} \times \frac{10}{100} = \underline{10 \text{ THz}}$$

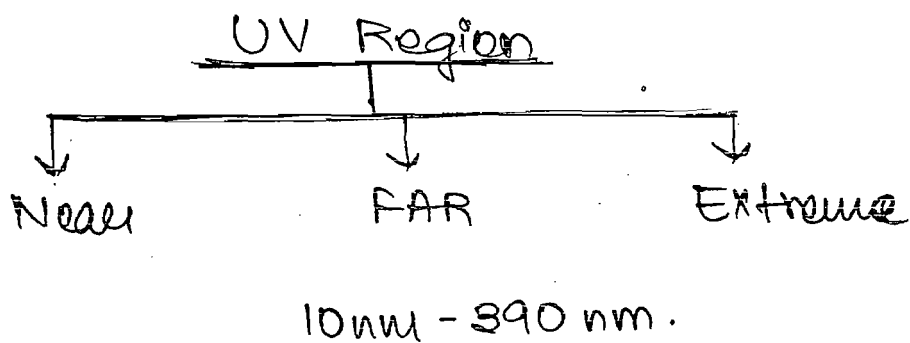
IR Region:



#



#



⇒ When dealing with Ultra high freq. such as light it is common to use wavelengths as units rather than frequency.

⇒ The BW of commⁿ system is 10% of carrier freq. which is said to be BUR (Bandwidth utilization Ratio).

IR Region →

→ The Band of light freq. i.e too high to be seen by human high with wavelength ranging from $770 \text{ nm} - 10^6 \text{ nm}$.

* → The optical fiber system generally operate at IR Region.

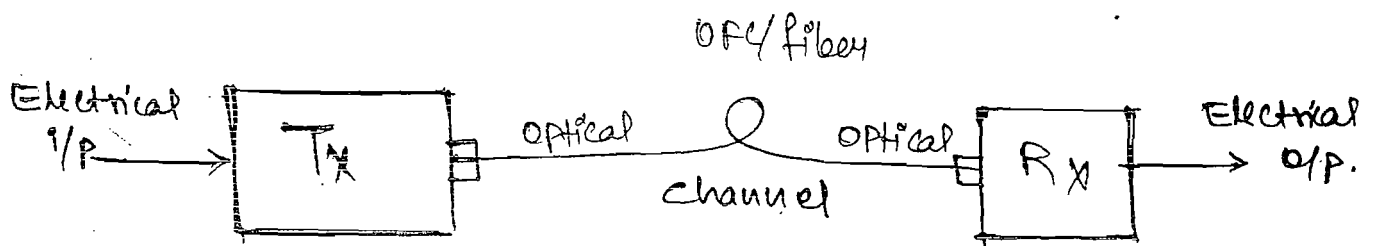
Visible Region →

→ The band of light freq. to which human eye will respond with wavelength ranging from - $390 \text{ nm} - 770 \text{ nm}$.

UV Region →

→ The band of light freq. that are too small to be seen by the human eye with wavelength ranging from $10 \text{ nm} - 390 \text{ nm}$.

Simple Block diagram of OC:



In 'Tx':

- ① E/O Conversion
- ② Light source
 - LED
 - LASER

③ Intensity Modulation

1 - ON $\rightarrow$ +5V

0 - OFF $\rightarrow$ +1V

Channel:

- $\rightarrow$ Dielectric Nature.
- $\rightarrow$ Material ① Glass ② Plastic.
- $\rightarrow$ Loss $\downarrow$

Rx:

- * ① O/E Conversion
 - ② Light detectors
 - $\rightarrow$ PIN PD
 - $\rightarrow$ APD
 - ③ Signal Restorer.
- } Opposite of Tx

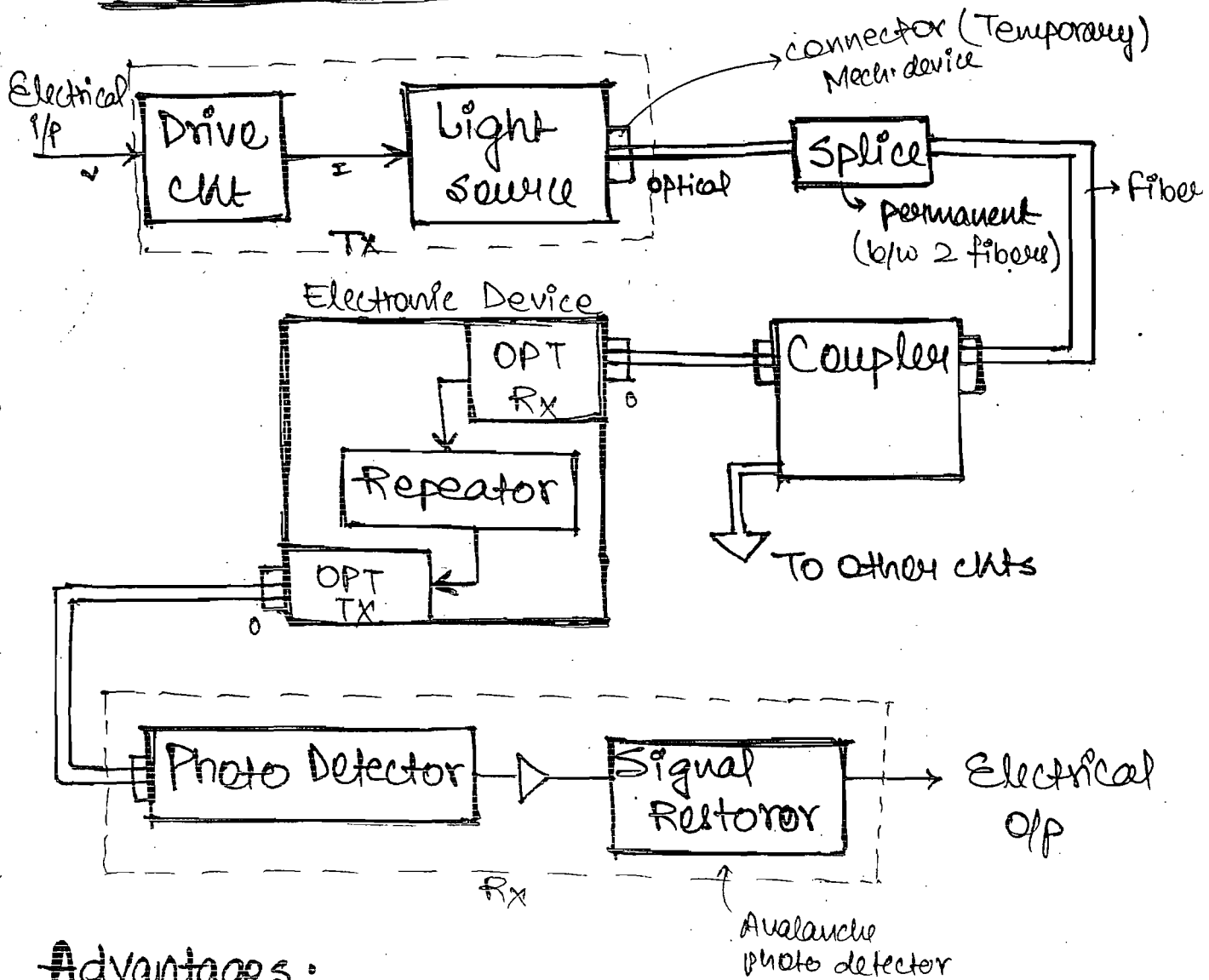
Note:

Carrier: Optical / Light

frequency: $10^{12} - 10^{16}$ Hz

Wavelength: 800 nm - 1600 nm.
in OC

Elements of OC systems :



Advantages:

1. BW is High
2. Transmission loss $\downarrow$
3. less weight & size.
4. Security is very HIGH.
5. Abundant raw material (Bahut Glass (Silica $\rightarrow$ sand) hai)
6. More immune towards Interference.
7. More distance.
8. Reliability $\uparrow$.

Disadvantages :

1. Cost is HIGH
2. Specialized training & equipments are required.
3. Remote Electrical Power supply.
4. Strength is less.

Review of Optics :

① Nature of Light : Dual Nature

② Wave Nature - given by Maxwell

$$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}} = 3 \times 10^8 \text{ m/sec.}$$

③ Particle Nature - given by Plank's & Einstein.

$$E_p \propto f.$$

$$h = 6.626 \times 10^{-34} \text{ J-sec}$$

$$\Rightarrow E_p = hf$$

$$\Rightarrow E_p = h \times \frac{c}{\lambda} = \frac{hc}{\lambda}$$

$$\Rightarrow \boxed{\lambda = \frac{hc}{E_p}} = \frac{1.24}{E_p(\text{ev})} \text{ } \mu\text{mtr.}$$

$$\Rightarrow \boxed{\lambda = \frac{1.24}{E_p(\text{ev})} \text{ } \mu\text{mtr.}}$$