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Syllabus :

3Q ① Optical communication (OFC)

2Q ② Cellular communication (Hybrid) → ① GSM ② CDMA

1-2Q ③ Satellite communication (wireless)

2Q ④ Microwave communication (wireless) → MHz / GHz

- ① Wave propagation
- ② Microwave Antenna
- ③ RADAR

5Q ⑤ Data Communication.

- ① OSI / ISO - 7 layer
- ② TCP / IP - 5/4 layer
- ③

In Comm^{n}
- → C(t)
- → Sinusoidal
- → MHz

Channels
- → copper } Comm^{n}
- → co-axial }
- → wave guide
- → OFC
- → Power lines

Weightage :

① Prelims → 12-16 Que

② Mains → 80-100 Marks

Textbooks :

Optical Comm^{n} - Senior

Satellite " - Pratt

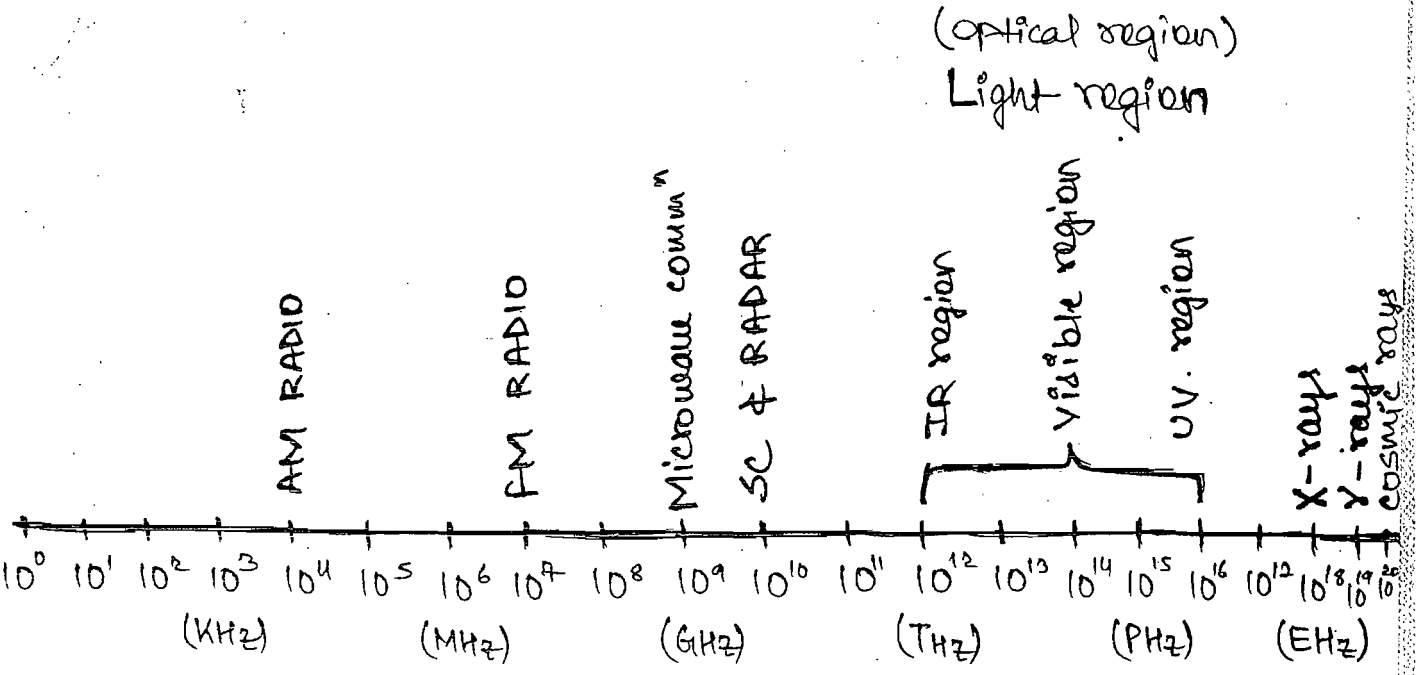
Cellular " - Rapport

Data Comm - Forouzan

Optical Communication

INTRODUCTION -

Electromagnetic Spectrum :



$$\downarrow\lambda = \frac{c}{f\uparrow}$$

#

BUR :- Bandwidth utilization Ratio

BUR = 10% of f_c

Case ①

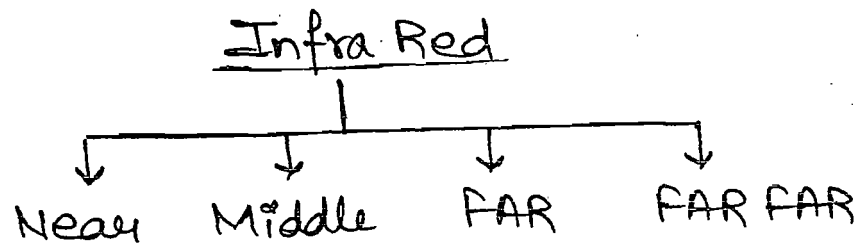
$f_c = 100\ KHz$

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

Case ② $f_c = 100\ THz$

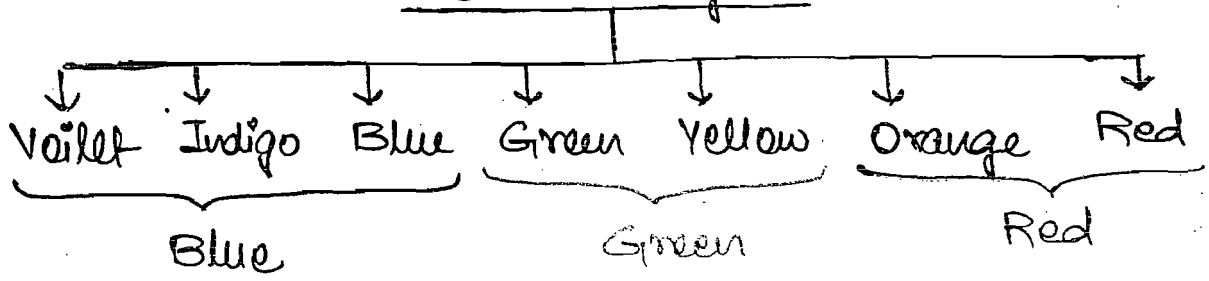
$BUR = 100T \times \frac{10}{100} = \underline{10\ THz}$

IR Region:



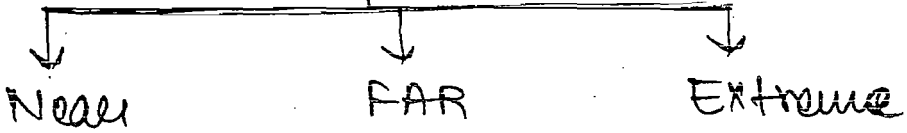
770 nm - 10^6 nm

Visible Region



390 nm - 770 nm

UV Region



10nm - 390 nm.

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

⇒ The BW of comm^{n} 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 nm - 10^6 nm.

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

Visible Region →

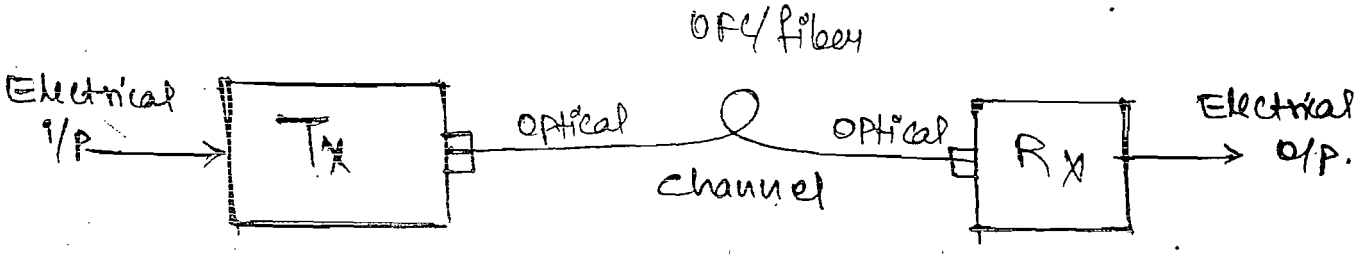
→ The band of light freq. to which Human eye will repond with wavelength ranging from -

390 nm - 770 nm

UV Region →

→ The band of light freq. that are too small to be seen by the Human eye with wavelength ranging from 10 nm - 390 nm.

Simple Block diagram of OC:



In 'Tx':

① E/O conversion

② Light source
→ LED
→ LASER

③ Intensity Modulation

1 – ON → +5V

0 – Off → +1V.

Channel :

→ Dielectric Nature.

→ Material ① Glass ② Plastic.

→ Loss ↓

Rx :

*① O/E Conversion
② Light detectors:
→ PIN PD
→ APD
③ Signal Restorer.

} opposite of Tx.

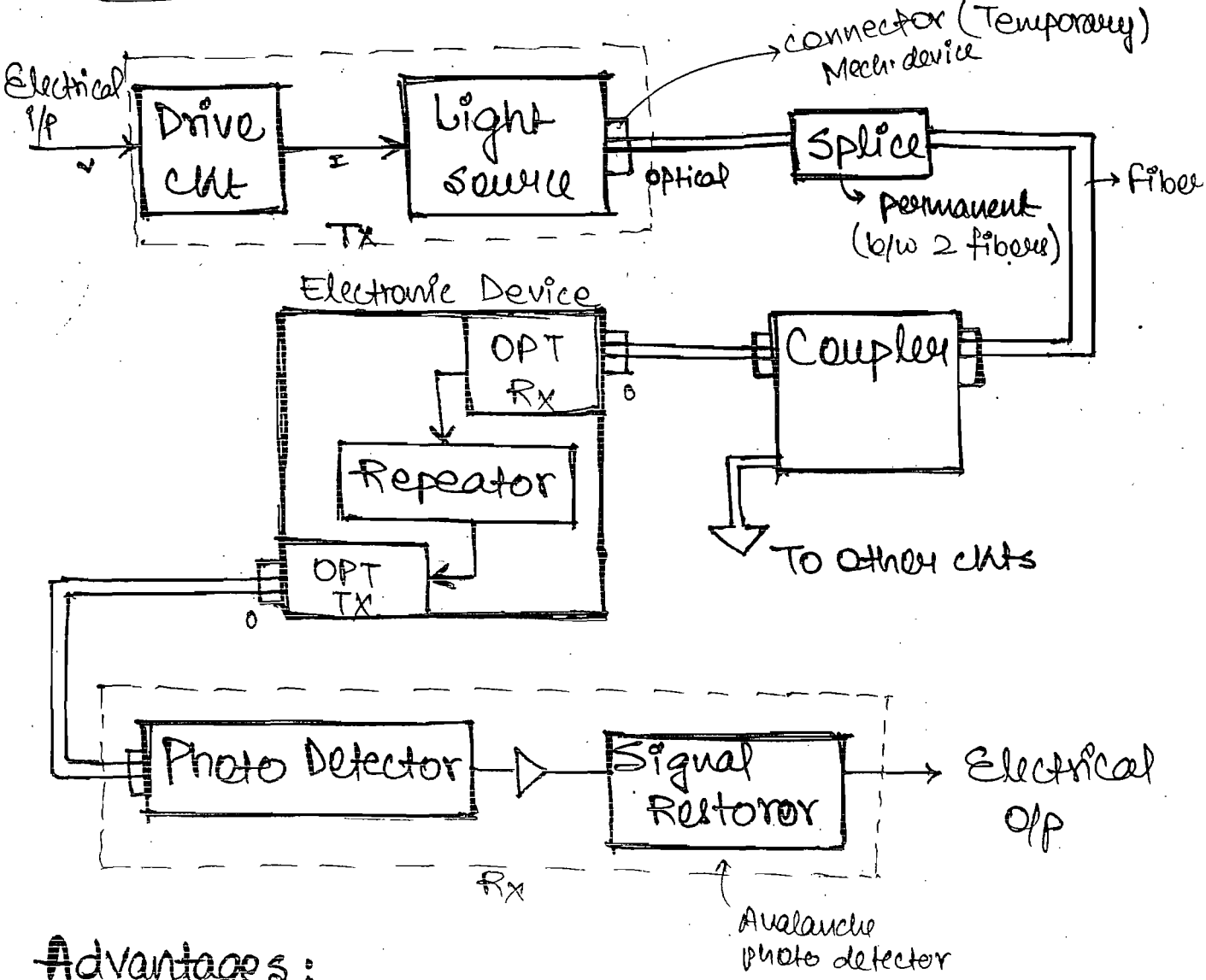
Note :

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 ↓
3. less weight & size.
4. Security is very HIGH.
5. Abundant raw material (Bahut Glass (Silica → Sand) hai
6. More immune towards Interference.
7. More distance.
8. Reliability ↑.

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

- ⓐ Wave Nature - given by Maxwell

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

- ⓑ Particle Nature - given by Plank's & Einstien.

$E_p \propto f$.

$h = 3.36 \times 10^{-34}$ J-sec

$\Rightarrow E_p = hf$

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

$\Rightarrow \boxed{\lambda = \frac{h \times c}{E_p}} = \frac{1.24}{E_p(eV)}$ μmtr

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