Ans

① Intramodel	intermodel.
→ used in single mode fibers	→ used in multimode fibre
→ known as material dispersion	→ as term as modal dispersion
→ less pulse	→ more pulse
→ wavelength of light is the cause	→ propagation of light is the cause
→ unit is ps/km	→ unit is ns/km

dispersion : splitting of white light into 7 constituents.
(i) polarisation dispersion : both in sigle / multimode fibre
(ii) chromatic : mix of intramodel & intermodel

② Luminescence	Incandescence
→ emission of light without heating to high temp	→ with
→ eg. fluorescence, phosphorescence.	→ eg. Fire, candle, bulbs
→ does not involve high temp	→ involve high temp
→ high energy	→ low energy
→ Heat is not used	→ Heat is used

③ Photodiode : converts light energy into electrical energy

Types

(i) PN diode : consist of PN junction that absorb light and generate photocurrent.

(ii) PIN : detect light with higher wavelength.
: wide depletion layer.

(iii) Avalanche : higher voltage than PN, PIN
Photodiod : short period of time more current flows

(iv) Schottky : uses metal-semiconductor junction
Photodiode

Advantage :

→ high sensitivity
→ fast response time
→ less noise
→ wide range
→ small size
→ less power consumption.

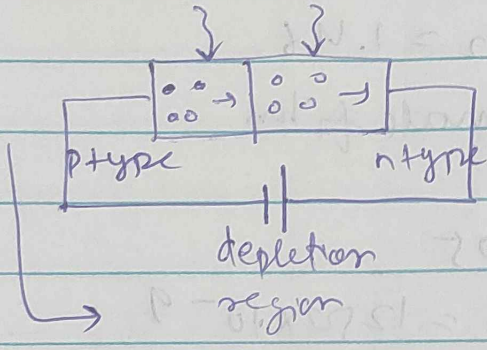
④ Photodetection in semiconductors.

→ converts optical signal into another form of signal.

→ converts optical signal into electrical signal.

⇒ Principle

when a photon with sufficient energy is absorbed by semiconductor, it generates e^- holes pair from valence band to conduction band.



⑤ factors that cause rayleigh scatting

→ scatters of light particles is much smaller than wavelength of light

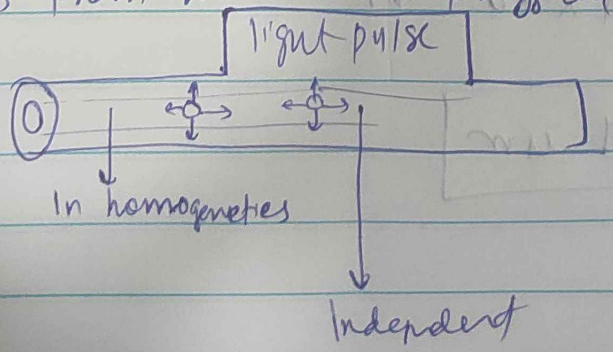
→ light is scattered by small spherical volume

→ longer wavelength scatter more than shorter wavelength

→ small particle, scatter light with shorter wavelength

→ blue light is more scattered than red light

→ results from non-ideal physical properties



④

Fluorescence	Phosphorescence
→ Immediate light emission	→ Delayed light emission
→ Short life time	→ long life time
→ non-radiative	→ radiative
→ sensitive	→ less sensitive
→ used in biological imaging	→ used in OLED technology

①

$n_1 = 1.465 \quad n_2 = 1.46$

∵ it is single mode fibre

$N_m = 1$

$V_{max} = 2.405$

$\lambda_0 = 1200\,nm = 1250 \times 10^{-9}$

$$V_{max} = \frac{\pi d}{\lambda_0}\sqrt{n_1^2 - n_2^2} = \frac{\pi (2 r_{max})}{\lambda_0}\sqrt{n_1^2 - n_2^2}$$

$$\Rightarrow$$

$$r_{max} \Rightarrow \frac{V_{max} \cdot \lambda_0}{2\pi\sqrt{n_1^2 - n_2^2}}$$

$$= \frac{2.405 \cdot 1250 \times 10^{-9}}{2(3.14)\cdot\sqrt{1.465^2 - 1.46^2}}$$

$$= 3.9 \times 10^{-6}\ m$$

$$\boxed{r_{max} = 3.9\ \mu m}$$