

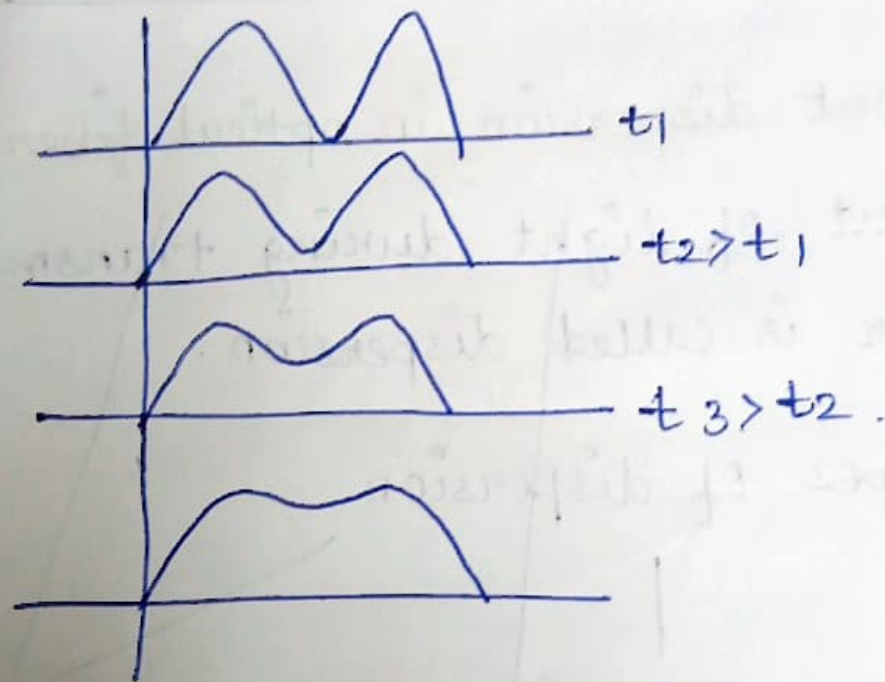
4 marks

① compare intramodal and intermodal dispersion

| intramodal | Intermodal |
|---|--|
| → Used in singlemode fiber | → Used in multimode fiber |
| → aka material dispersion | aka modal dispersion |
| → less pulse broadening | → more pulse broadening |
| → The main cause is difference in wavelength of light | → The main cause is difference in propagation modes of light |
| → measure of unit is ps/km | → ns/km |

② Explain about dispersion in optical fiber.

Dispersion : Splitting of white light into 7 constituent colors.



Intermodal dispersion

- occurs only in multimode fibers
- Has different group velocity.

Intra modal dispersion

- main wavelength that cause intra modal is material dispersion & wavelength dispersion
- polarisation dispersion:

~~also~~ Both in single/multimode there occurs polarisation of light & this causes polarisation dispersion

chromatic:

combination of inter & intramodal dispersion

4) Difference btwn ~~the~~ luminescence & incandescence

| | luminescence | Incandescence |
|---|--|--------------------------------|
| → | Emission of light without heating to high temp | with |
| → | Eg: Fluorescence, Phosphorescence | Eg: Fire, candles, light bulbs |
| → | does not involve high temp. | → Involves high temp |
| → | High energy efficiency | → Low |
| → | UV to excite the e^- | Heat is used. |

⑤ comment on Quantum efficiency

Measure of the effectiveness of an imaging device to convert incident photons into e^- .

~~Advantages of photodiode~~

Important parameter for evaluating the ~~performing~~ performance of photosensitive devices, provides measure of devices ability to convert light energy into electrical energy.

$$\eta = \frac{I_p/q}{P_o/h\nu}$$

Amount of light energy absorbed according to e^- -hole recombination.

⑥ List out the types and advantages of Photodiode.

Photodiode converts light energy into electrical energy.

Types

PN - photodiode : consisting of a PN junction that absorbs light & generates photocurrent.

PIN : \rightarrow wider depletion region

\rightarrow Detect light with longer wavelength

Avalanche photodiode : higher voltage than
PN, PIN

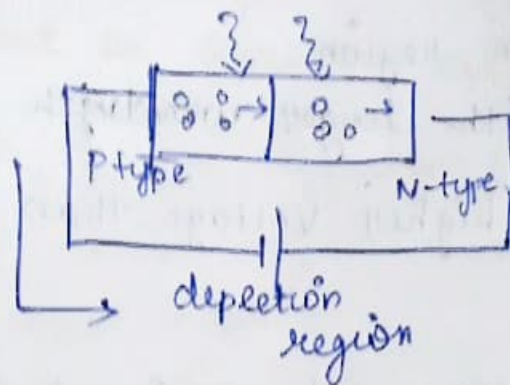
Schottky photodiode : uses metal-semiconductor
junction

Advantages:

- \rightarrow high sensitivity
- \rightarrow fast response time
- \rightarrow low noise
- \rightarrow wide Dynamic range
- \rightarrow small size
- \rightarrow low power consumption

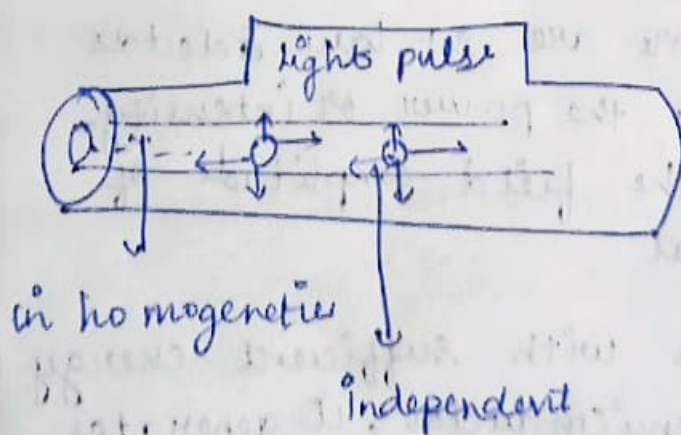
7) Give the principle of photo detection in semiconductor.

- \rightarrow Converts an optical signal into a signal of another form
- \rightarrow most convert optical signals into electrical signal
- \rightarrow All photodetectors are sq-law detectors that respond to the power or intensity, rather than the field amplitude of an optical signal
- \rightarrow when a photon with sufficient energy is absorbed by semiconductor, it generates an e^- -hole pair by exciting an e^- from the valence band to conduction band



⑧ Factors that cause Rayleigh scattering

- Scattering of light by particles much smaller than the wavelength of light.
- light scattered by a small, spherical vol of variant R.I as bubble, droplet.
- It results from non-ideal physical properties of the manufactured fiber
- It results from inhomogeneities in the core & cladding
- Because of these inhomogeneities prob like
 - ↳ ~~fluctuation~~ fluctuation in R.I
 - ↳ Density & composition variation



⑧ compare fluorescence and phosphorescence.

| Fluorescence | Phosphorescence |
|---------------------------------------|--------------------------------|
| → Immediate light emission | → Delayed light emission |
| → short life time | → long lifetimes |
| → non-radiative | radiative |
| → sensitive | less sensitive |
| used in Biological imaging, chemistry | security inks, OLED technology |