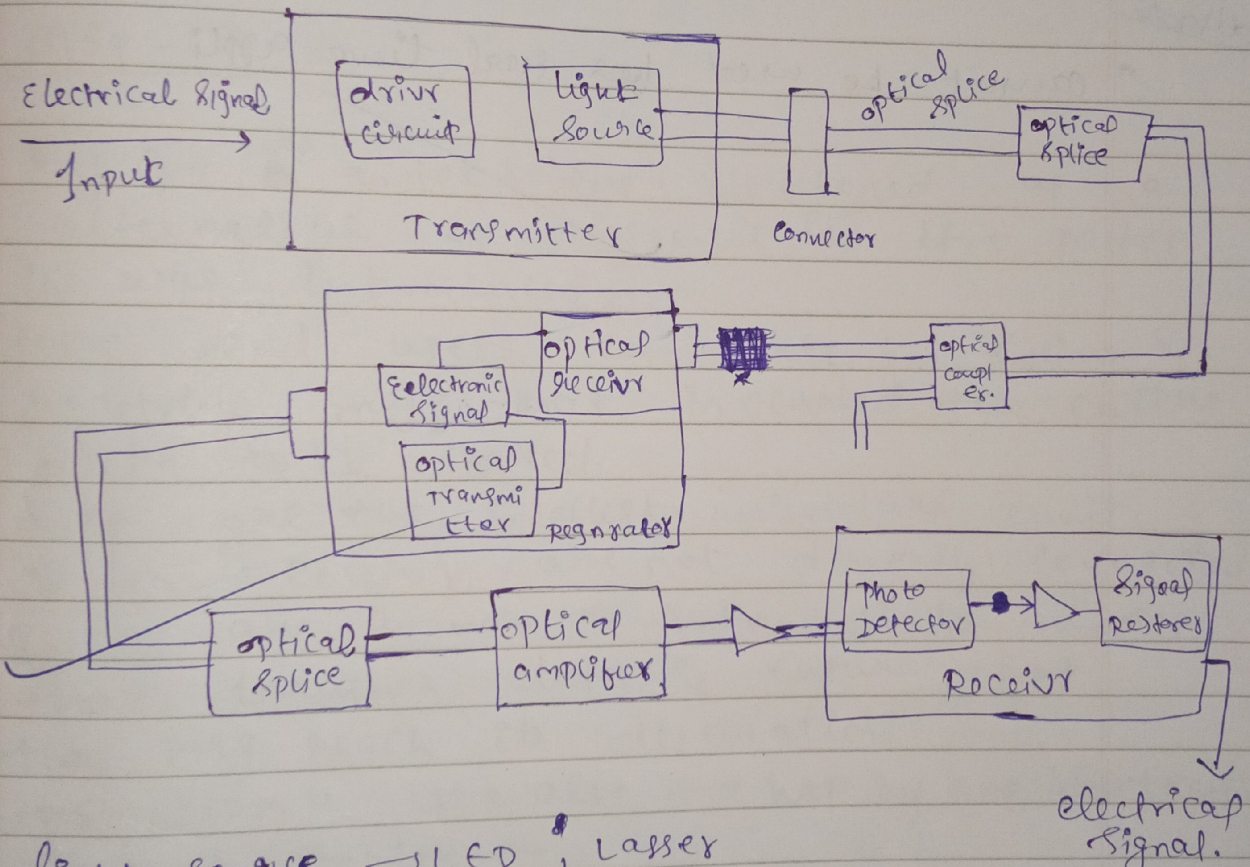
appli of T =
used in commun & medical industry, broad casting.

Module - IV

Optical Fibre

(convert electric to light energy. → data (T))

→ optical fibre working =



- light source → LED, Lasser
- Transmitter → conversion.
- Drivr circuit → light source generate ചെയ്യുന്നതിന്റെ intensity control ചെയ്യുന്നു.
- Connector വഴി optical fibre ലേക്ക് pass ചെയ്യുന്നു.
- optical splice – length increment ചെയ്യുന്നു.
- optical coupler – ഒരേ light signal-നെ multiple users ന് കിട്ടാൻ.

(ദൂരെയുള്ള communicate ചെയ്യുന്ന ഒരേ signal-നെ regentr. use ചെയ്യുന്നത്.)

O.F
* long distance (f)
* long info capacity
* small size & low weight
* enhanced safety & ease signal security.

* limited appli..
* low power
* Difficult to install so high cost

— optical receiver → optical signal-an receive
(again optical splice)
— optical amplifier — weak signal-an strong signal
↳ receiver (data may be video / image) →
signal restore → electric signal

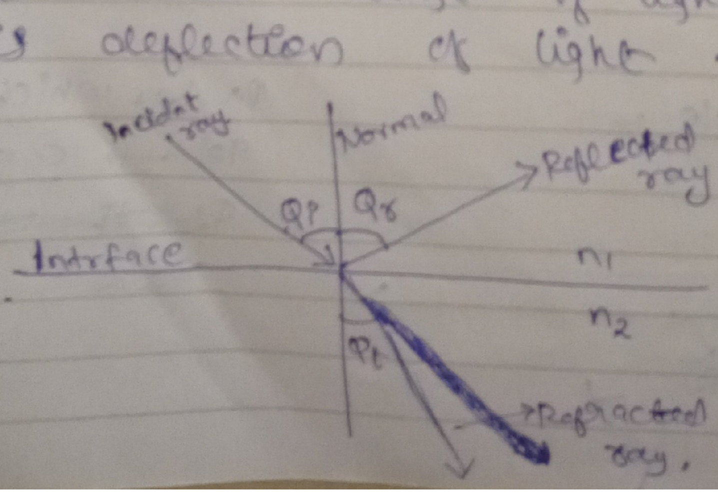
⇒ properties of light = (light propogation theory)

Ray theory → light particle nature
mode theory → ~~light is~~ wave ntr. (after drawback of ray theory)

Reflection → same angle reflect
Refraction → bending of light.

* $c = 3*10^8$ m/s. (velo in vaccum → c)
* light travels faster in vaccum, it's velocity in vaccum, $c = 3*10^8$ m/s.
  In other medium it is < c.
* Ratio of velocity of a light (c) in a vaccum to the velocity of light in anther medium (v) → Refractive Index (n).
  $n = c/v$.

* whn light passes from 1 medium to anotr causes the change of speed, which results in the change of light travelling dir.
  This deflection of light → Refraction.



θ_i → incident angle
θ_r → reflected angle

normal + θ_i → angle of incidence

[$\varphi_i = \varphi_R \longrightarrow$ Law of reflection.
$\varphi_i \neq \varphi_R \longrightarrow$ Total interanal reflection]

* relation b/w incidnt ray & reflection
$\varphi_i = \varphi_R$ (Law of reflection.)

* relation b/w incidnt ray & reflection ray by using Snell's Law,

$$n_1 \sin \varphi_i = n_2 \sin \varphi_t$$

$\varphi_i \uparrow \ \varphi_t \downarrow$. I.

where n_1 & n_2 → Refractive indexes
φ_i → angle of incidnce

[refracted ray full ആകാതെ reflection നടക്കുന്നുണ്ട്
→ partial internal reflection / refraction.]

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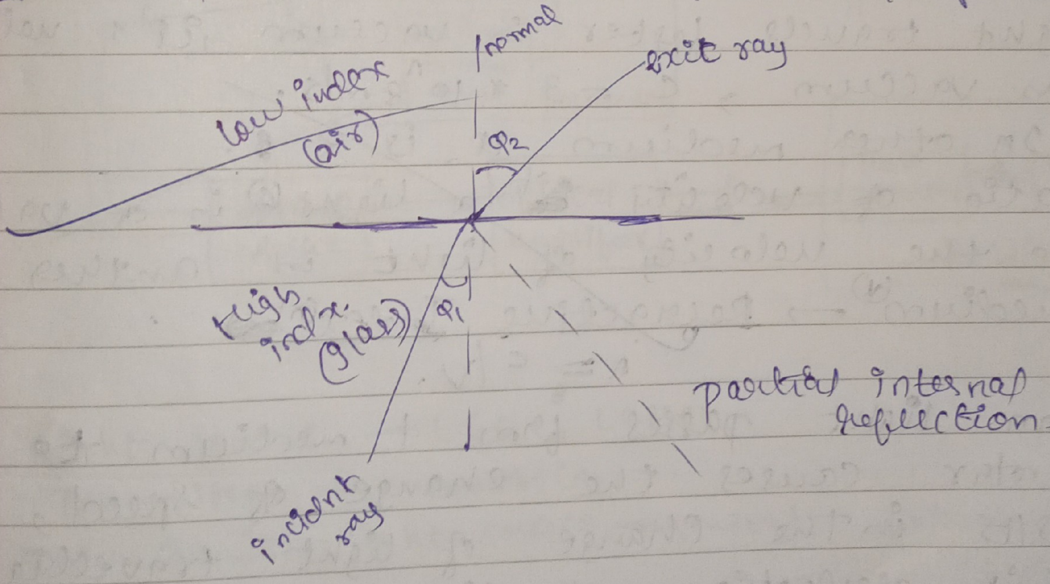
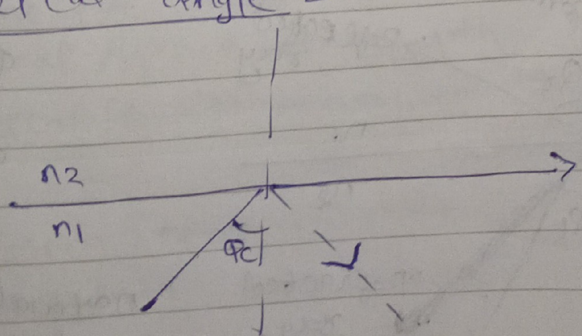


* Critical angle =

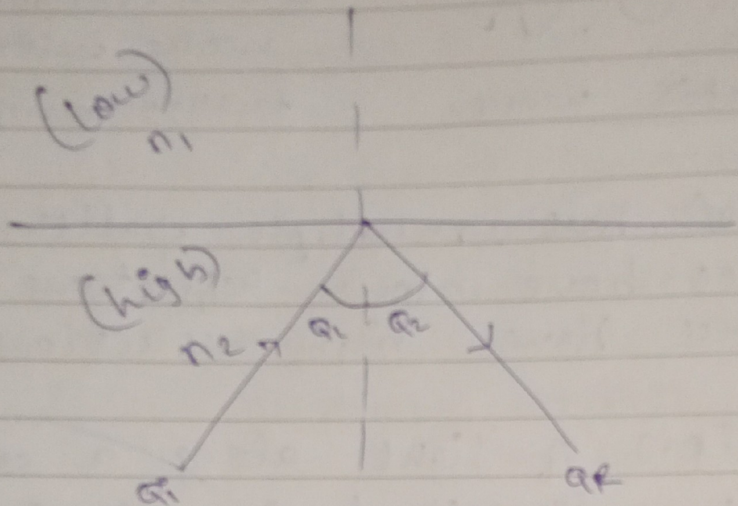
φ_i for which the φ_t is $90° \longrightarrow$ c. angle

~~$\varphi_i = \varphi_t \to \varphi_i$~~

~~φ_t~~



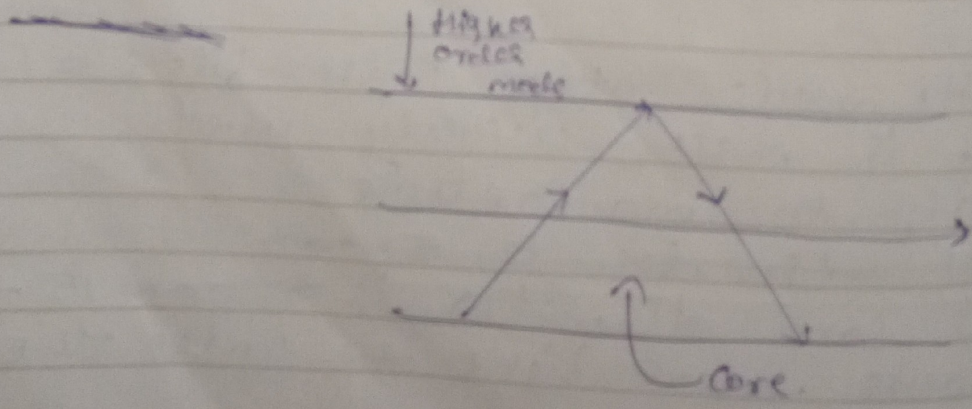
* Total Internal Reflection (TIR) =



* If the angle of incidence is more than the C. angle → TIR.
* According to Snell's Law, $n_1 \sin \theta_1 = n_2 \sin \theta_2$ as the value of θ_1 ↑ses, θ_2 also ↑ses.
* when θ_2 becomes $90°$ → C. angle (θ_c) Light ray in air || to light ray in glass surface, ∴, $\sin \theta_c = \frac{n_2}{n_1}$

II Mode Theory =

* Including wave ntre.
* wave ntr-നെ analyse ചെയ്യാൻ use ചെയ്യുന്ന maxwell's eq.



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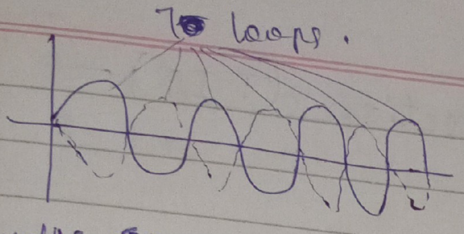

Standing wave.

ഒരു wave ഉണ്ടാകുന്ന അതിനെ dis ഉണ്ടാക്കി wave with same energy ആയിട്ട് → S.W.

* 1 light signal hue multiple patterns / modes
* lower modes have low reflections. & higher modes have high reflections.

* The propogation of light along a wave guide can be discribed in terms of a set of guided electro mag waves → modes of the wave guide.

* optical fibre 3 configration —

1) Single mode step index.
2) Multi-mode graded index fibre.
3) multi mode step index fibre.

1) Single mode stp index =
* central core is small
* typical core size are 2-15
* Also → Fundamental / monomode fibre.

2) multi mode step index fibre =
* It is most widely used
* easy to manfactrue
* Its core diameter is 15-1000
* Allows more light to enter the cable.

3) multi mode graded index =

* Core has an index of refraction that uses as the radial distance from the center of the core ↑ses.
As a rslt light travels faster near the edge of the core than near the centre.

→ optical sources =

* optical trasmittr converts electrical input signals to corresponding light signals,
* High optical power, ↑ reliability, low weight & low cost.
→ 2 types light sources —

1) LED (light emitting Diode) & lasser.

characteristics	LED	Lasser
1) output power	lower	higher.
2) speed	slower	faster.
3) cost	less	more
4) ease of operation	easier	more difficult

a) LED. =

* semicond device that emits light when an electric crnt flows through it.
* when crnt passes through LED, the e free combine with holes emitting light in the process.
* LED allow the crnt to flow in the

forward (dis) & blks in reverse bias)

b) Lassey =

* It is a semi cond that uses pn junction for producing radiation with same freq & phase, which is either in the visible / infrared spectra.
* Also → an injection lasers diode. & the technology is similar to LED

→ Photo Detector =

* Also → photo sensors.
* Are sensors of light / electro mag radiation
* ~~semi cond bar~~
* Have a p-n jun that convert light photons into crnt
* photo diodes & photo transistors are the

Completed
13/4/23