B. Tech [First SEMESTER]
EXAMINATION, 2020
ENGINEERING PHYSICS

SECTION – A
[Short Answer Type Questions]

Q-1 (i) Why can two Independent Sources of light Produce Interference?

ANS⇒ (i) Two Independent Sources of light cannot be coherent because they cannot Emit wave continuously. The two Independent Source of light will not have same Phase or constant phase difference between them.

(ii) They will have Random phase difference between them

Q-2 Define ~~Inertial~~ Inertial and non-Inertial frame of Reference?

Ans Inertial frame Refrance

that frame of Refrance In which Newton's of Inertia called Intorial frame of Refrance [In which newton law are followed or valid

Non-Inertial frame Refrance

The frame of Refrance is one which Newton's law are obeyed called an Non Intial frame It Does not accelerate unlike to non Intial frame.

Q-3 How will you show that no particle can move with a velocity greater than the velocity of light In an Inertial fram?

If m_0 is the mass of the body. If It AS Rest

If M is the mass of the body moving with velocity V

According mass varition with velocity

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2 c}{c^2}}}$$

If 'v' is greater than c then value of $\sqrt{}$ will be negative

Q Define proper and improper time interval?

Proper time Interval:-

A time interval the shortest time interval that can be measured Between two Event as measured by an observed who is present at Both Event.

Proper time measured in the Refrance frame where the Event occur at the same location

'Improper time Interval':-

At time Interval that longer than the proper time. This occur when a observer is moving Relative to the system observed

$$\tau = t_0 \sqrt{+ \frac{v^2}{c^2}}$$

τ -> the measured time in some Refrance frame

t_0 -> the proper time in Refrance frame of O

c -> the speed of light

Q 5- Define the phenomena of double Refraction?

If the phenomena due to which Beam of oridanary ~~up~~ uspolorized light is made to pass through a quartz crystals to calcite crystals & the two Refracted Rays one produced the property is called Double Refracted

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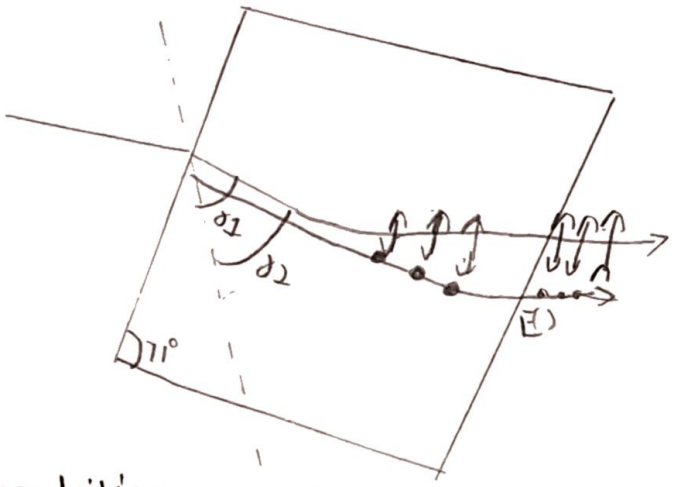


Explain the condition to obtain suistained interferance?

(i) The wave front must have generated from coherent source. ie the phase different Between the wave front must Remain Indepent of time

(ii) The wave front must have the same frequency

(iii) The wave fronts must be similar state orientation

(iv) The Distance b/w the two source should be of the wavelength of source light used

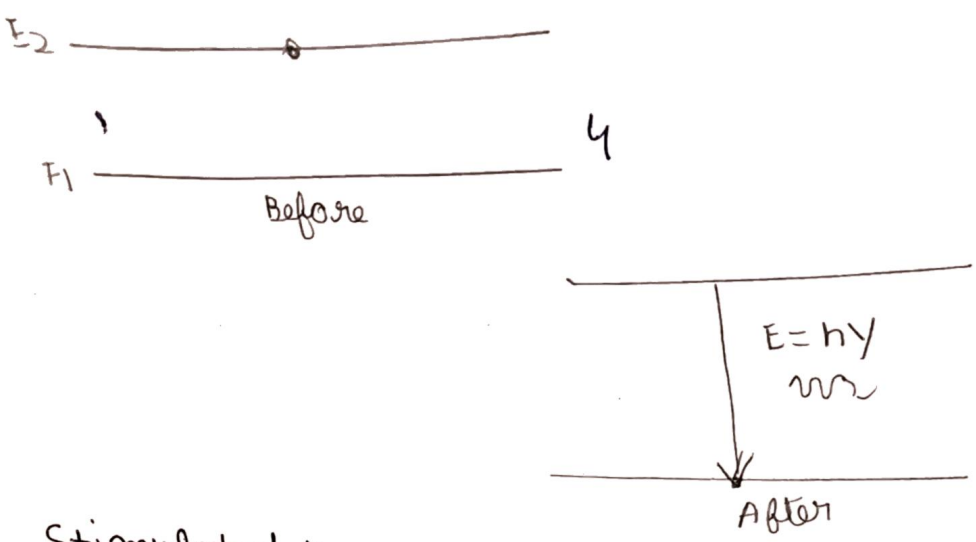
(v) The two source must be narrow.

Differential Between Spontaneous and stimulated emission which one is Required for laser

→ Ans- The lower Energy state by Realeasing Energy $h\nu - E_2 - F_1$ in the form of Radition the transtion is known as Spontaneous Emission

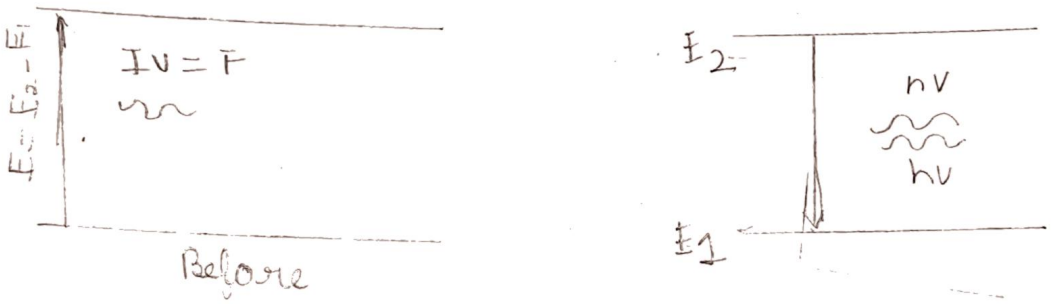
" The Rate of sponeous transitions Depend on the properties of State E_1 and E_2 is given as

$$(P_{21})_{spontaneous} = A_{21}$$



Stimulated Emission

one incident photon we get another photone of same frequency in same phase travelling in same direction and are same state of polarization such transtion called stimulated emisstion



Thus the stimulated emission is crucial for laser operation supported by population Inversion and an optical cavity to sustain amplify the light.

Q=8 Explain the construction and working of Ruby laser in short -

Construction -> The Ruby Rod placed between two mirror to create an optical cavity one end of the Rod highly silvered while the order partially silvered.

Working → A flash tube pump the Ruby Rod with high Energy light Excited the Ruby move along and causing them to Emit photons.

The Electron is the Ruby move from lower energy State to the higher Energy. State Emitting laser light process.

Q-9 Give four Important Application of laser

Laser marking to imprint Unique Identification number or product

- Laser micromaching to Remove material at the microscopic scale
- Laser light Shows for Entertainment
- cutting Laser can cut glass and quartz

Q=11 What is principle of operational of an optical fibre?

"Total Internal Refp Reflections"

optical fibre work on the principle of total Internall Reflection they consist of core and Cladding where light Entering the core at Certain angle Reflected Back into the core Instead of passing into cladding.

Q12 Define acceptance angle and numerical aperatus

Acceptance angle is the larger angle for light to Enter the fibre Effectively.

Acceptance angle is bigger angle at which angle at which light can Enter on an optical fibre and Still be guided though it

Numerical aperature is the number which defines the light acceptance or gathering capacity of fibre in simple terms a maximum angle made it angle (acceptance angle is numerical operature NA)

$$NA = \sin\theta \sqrt{n_1^2 - n_2^2}$$

In graded index fibre numerical opeture which is function of Radius can be given as.

$$NA(r) = \sqrt{n^2(r) - n^2}$$

NA(r) is numerical operture at the Distance from Centre

If we denote $n_1 - n_2 \; \Delta r$, $n_1 + n_2 = 2$

$$\theta a = \sin^{-1} 2n \Delta n \; 1/2$$

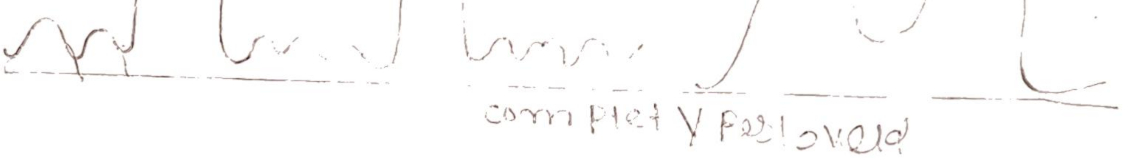
$$\sin^2 \theta a = Na = 2n \Delta n$$

$$NA = (2n\Delta n)$$

~~Write~~

Define ~~Res~~ Resolving power of an optical instument

It's abality to distingush optical instrument between the image of closely placed object known as Resolving Power The image formation of slit in the single slit diffraction intensity Distibution Therfore when two image overlap on each other.



Long-Answer type Question :

Describe various type of optical fibre Based on modes material and Refractive Index profile?

optical fibres which foarm a passage way for transmitted Optical signal are designed in different ways to meet different Requirement

On the Basis of Refractive Index profile of the core the way in which signal propogates down the core the fibres are broadly divided into three (mainly) categories

=> Multimode fibres (MMF)

=> Singlemode fibre (SMF)

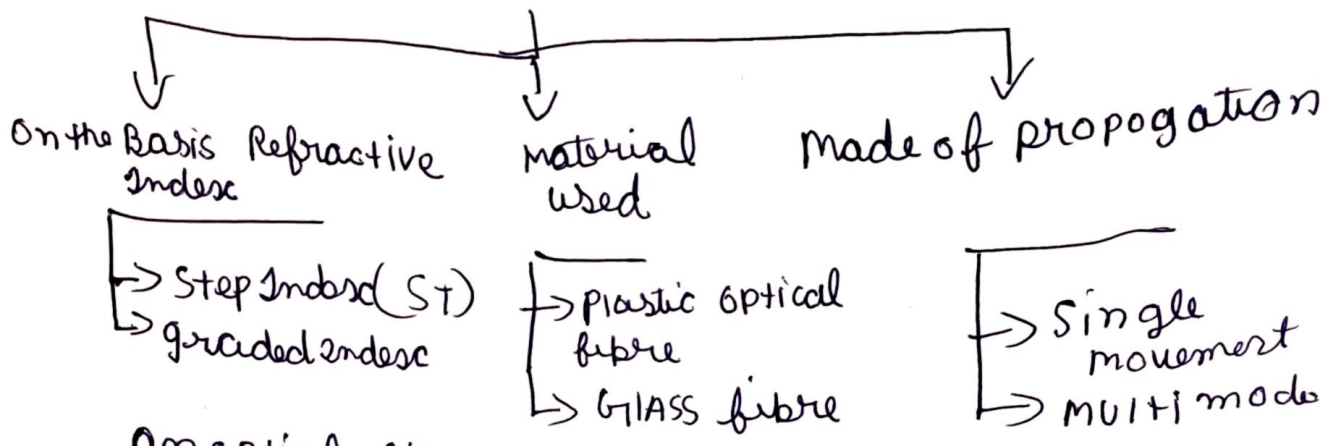
In the multimode fibre core diameter is greater than 10um

Signal mode propogation can be achieved by Reducing core of diameter less than abou ten times the wavelength of the progation

Multimode fibre :-> The transpartment glass core with a constant Index of Refraction is surrounding by another waxial glasses or plastic cladding of the Index of Refraction lower than that of the core The multimode ff fibre has longer core

Siglemode fibre => In the order disperstion upto almost lead a and b Increase the Informatio carrying capacity a fibre with core diameter Less than ten times wavelength of propogation Light will be In forecated

The most common life of single mode or monomode or fibre have diameter of 8 to 10 um & 10 um & designed for use in infracted Region



an optical fibre that made out polymer is flexable glasses or plastic can transmit light from one End to other such fibre optics 'communicatoin' where they permit transmisstion over longer distances and higher Bandwidthes then Eledrical cables

the distribution of Refractive Indices of material within an optical fibre fibre has step -Index and the cladding has lower uniformly Distributed Index

The Index of Refractive (something Refferred to as Refractive Index IOR) AS ESSTIONal chorcterstic of optical ~~fi~~ fibre Because plays Greedly

Working

An the un polorised light is in incident on the End of faces of nicol prism & split up to two harts E-Rays O-Rays passing from ~~calo~~ candela Balson travel from denser ($\mu_o = 1.66$) denser

$\mu = 1.55$

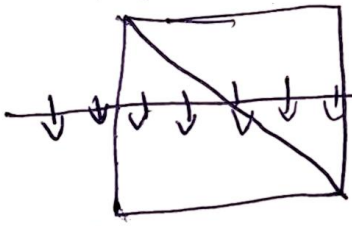
When O Ray is made to fall candela Balson layer at angle greater than the critical angle for it then it will suffer total Internal Refraction ~~hence~~ hence only -E- Ray of transmitted

$$C = \sin^{-1}\left(\frac{\mu}{\mu_o}\right)$$

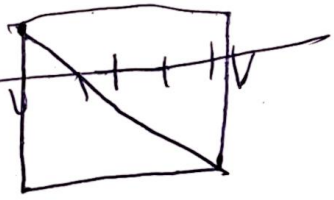
$$C = 69^\circ$$

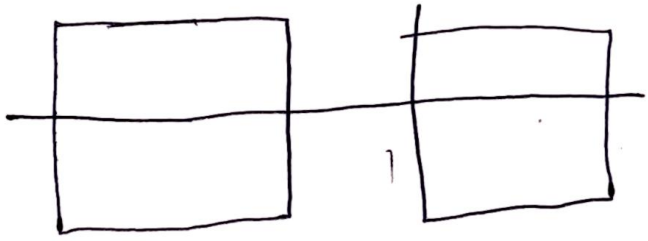
The total Internally Reflected Ray is finally observed by Black End side CG hence the nichol prism The x-Rays is Elimanted total Internal Reflected X only R Ray with Vibration parllel to principle section Section Passing through and the light Beam Energing from crystal is plane polarried.

Digram 1



Digram-2





an optics drived which is used 1828 william Nicol Designed an optical device by specially cutting to Eat calcite crystal for producing analysing Plane Polorized light known Nicol prism

It principle is Based on the phenemenica of Double Refraction.

principle of Nichol prism

When the polarized light Emit the calcite crystal. it sprit up into two plane polarised one Ray o-ray be the E-Rays.

The Nicole prism Designed such way as the Elimate the o-Ray by total internal Refraction Hence only the e-rays is trasmitted though prism

~~Constry~~.

Con Stoyuction

A calcute crystall of length ~~three thing~~ times at the width It takes the number of force at gE and CD are Reduced from 71 to 68° The crystal is cut into two half are cemented by this thin layer of candela Balson to transparment Substance. whose Refractive Index lies in mid way b/w of o-RAy 1.66. E=>1.49 C 4

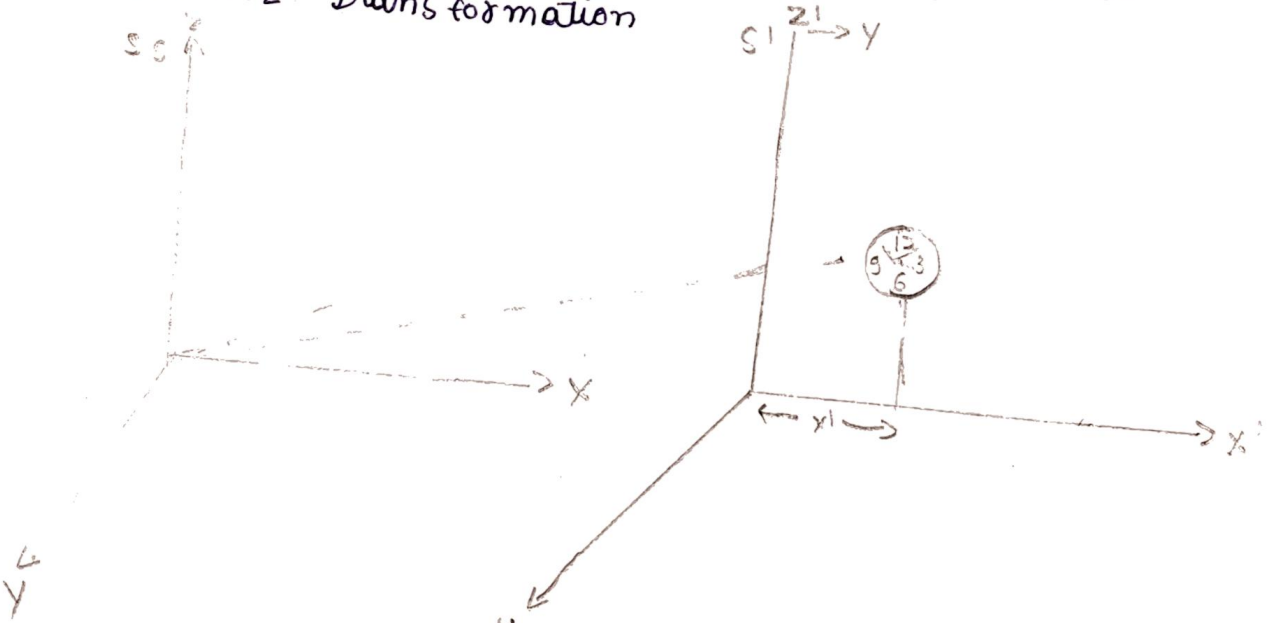
The Refractive Both Rays con dela Bolsen IS 1.5 I for Both Rays.

Derive the Expression for time dialution. with help of an Experimental Evidence that time dilution in the effect is Real Effect?

Ans⇒ The Influence of velocity of the frame of Refrance on time is being Discussed in the article using Lorentz Transformation Equations Consider two frame. Reference S and S' is moving with velocity v (Comparable to c) Relative to S along Postive x- direction.

When the clock is in the frame S' let the clock be situated x' in frame S' and the time Dilution Interval Between any two ticks is measured as to by observe in the same frame (Real time Intervals) whereas observe in another frame S (say stationary for convience) notice an apparent change in time Interval it is denoted by t.

Therefore using time Corridnates of Inverse Lorentz Transformation



fig=7

$t_0 = t'_2 - t_1$ (real)

$t = t_2 - t_1$ (apparents)

$$t = \frac{t' + \frac{x'v}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}$$

writing the Expression for the two timeticks as observe by an Observer In S-frame according the eq(2)

$$t_1' + \frac{x'v}{c^2}$$

$$t_1 = \frac{}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$t_2 \Rightarrow \frac{t_2' + \frac{x'v}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Subtracting Eq(3) from (4) time Interval as observer by different observer O & O' can be Related as

$$t_2 - t_1 = \frac{t_2' - t_1'}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

It show that is time dilating for moving observer.

the Direction Experimental Confirmation of time dilation is found in an Experiment on ~~to~~ cosmic Ray particle called mu-Sons μ-mesos are created at high attitudes in the Earth Atmosphere (at the height about 10 km) by ~~Intrac~~ Interaction of fast cosmic Ray Photons and are projected toward the Earth surface with very high speed about 2.29×10^8 m/s which is 0.998 of the speed of light (C) μ-mesons unstable decay into Electron on positrone with an average light time of about 2×10^6 sec therefore life time a μ-meson can Travel a distance