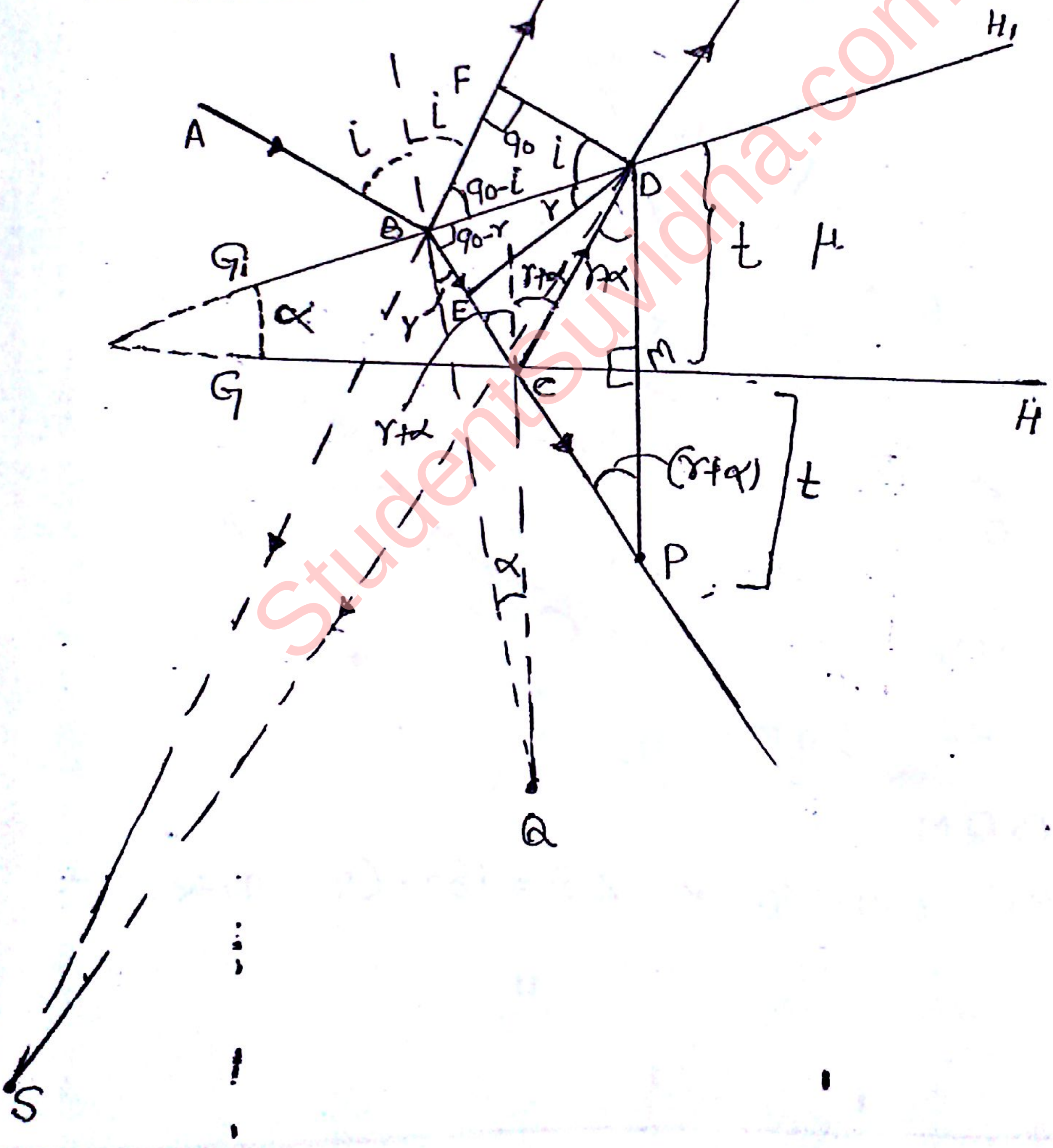
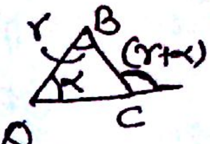
Wedge Shaped film:-

Consider two plane surfaces GH and G_1H_1 are inclined at an angle α, so that air film of increasing thickness is formed between two plane glass surfaces. Let μ be the refractive index of the material of the film. When this film is illuminated by sources of monochromatic light. Suppose a beam of monochromatic light AB incident at angle (i) at a point B on the uper surface G_1H_1. Then a part of this light will reflected in the direction BR.



and a part of light will be refracted in a direction BC This refracted ray will be incident at an angle $(r+\alpha)$ Because show in fig.



Then a part of this refracted light will be reflected at the denser surface in the direction CD. and comes out in the form of ray DR_1. So that our aim is to be study interference between two reflected ray BR and DR_1. From the fig it is observed that BR and DR_1 are not [redacted]. Parallel, but appear to diverge from a point S. Thus interference take place at S. Which is virtul. So that intensity at a point S is maximum or minimum depend upon path difference between the two reflected ray BR and DR_1. That is

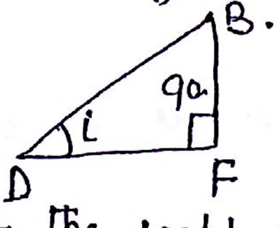
$$(BC+CD)\mu - FB (H) \text{ in air} - ①$$ $[\mu = 1]$ in case of air.

First of all find out value of BF.

we know $\mu = \frac{\sin i}{\sin r}$. Now find out value of $\sin i$ and $\sin r$ in fig.

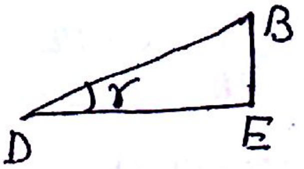
Now consider the fig. (1) in that take right angle Triangle DFB.

Value of $\sin i = \frac{BF}{BD}$.



Find out value of $\sin r$. consider the right angle Triangle. DEB. (Here draw perpendicular from the point D on the ray BC).

Value of $\sin r = \frac{BE}{BD}$.



Putting value of $\sin i$ and $\sin r$ we get value of μ.

$$\mu = \frac{\sin i}{\sin r} = \frac{BF}{\cancel{BD}} \times \frac{\cancel{BD}}{BE} = \frac{BF}{BE} \text{ or}$$

$\boxed{BF = \mu BE}$

Putting value of BF in eq. ①

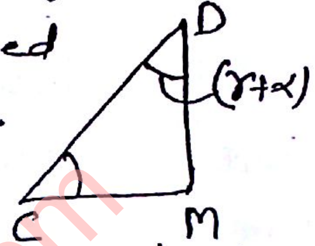
$$(BC+CD)\mu - \mu \cdot BE = \mu(BC+CD-BE) \quad —②$$

From the fig. value of BC can be written as:

$BC = BE + EC$ Putting this value in eq. ② we get

$$\mu(\cancel{BE}+EC+CD-\cancel{BE}) = \mu(EC+CD) \quad —③$$

In the fig: consider the right angle Triangle DMC

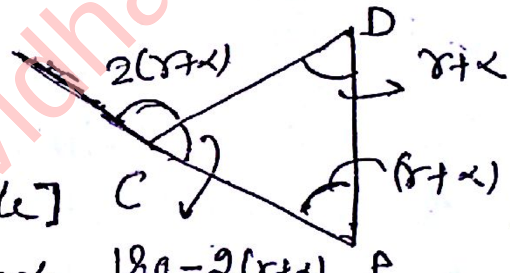


value of $\angle C = 90-(r+\alpha)$ Becase the refracted ray BC incident and reflected at an angle $(r+\alpha)$

Now consider Triangle DPC in this we can find out value of angle $\angle P$ and $\angle C$

So value of $\angle C = 180-2(r+\alpha)$

and $\angle P = (r+\alpha)$



Now consider the Two Triangle

ΔDMC and ΔPMC in these triangle

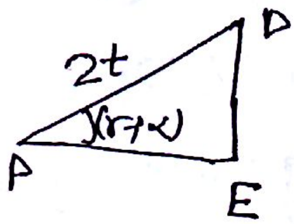
$\angle D = \angle P$
$\angle M = \angle M$
$MC =$ common.

When two angle and one side is common then such type of triangle is isoceles. Thus in these triangle $DM = MP$, $CD = CP$.

Thus value of CD can be written in eq. ③ we get

$\mu(EC+CP) = \mu(EP)$ Now find out value of EP.

consider the right angle triangle ΔDEP.



$$\cos(r+\alpha) = \frac{PE}{PD} = \frac{PE}{2t}.$$

$$PE = 2t\cos(r+\alpha)$$

Now putting value of EP we get

Thus we get Path difference between the two reflected ray will be:

$$2\mu t \cos(r+\alpha)$$

But according to Principal of reversibility When wave reflected from the surface of optically denser medium It suffer a phase change π if phase change π occur then additional Path difference $\lambda/2$ introduce in it Thus. total Path difference b/w two reflected ray will be

$$2\mu t \cos(r+\alpha) + \lambda/2.$$

So intensity at a point will be maximum only When path difference $= n\lambda$ Thus

$$2\mu t \cos(r+\alpha) + \lambda/2 = n\lambda$$

and intensity at a point will be minimum only When path difference $= (2n+1)\lambda/2$ Thus

$$2\mu t \cos(r+\alpha) + \lambda/2 = (2n+1)\lambda/2.$$