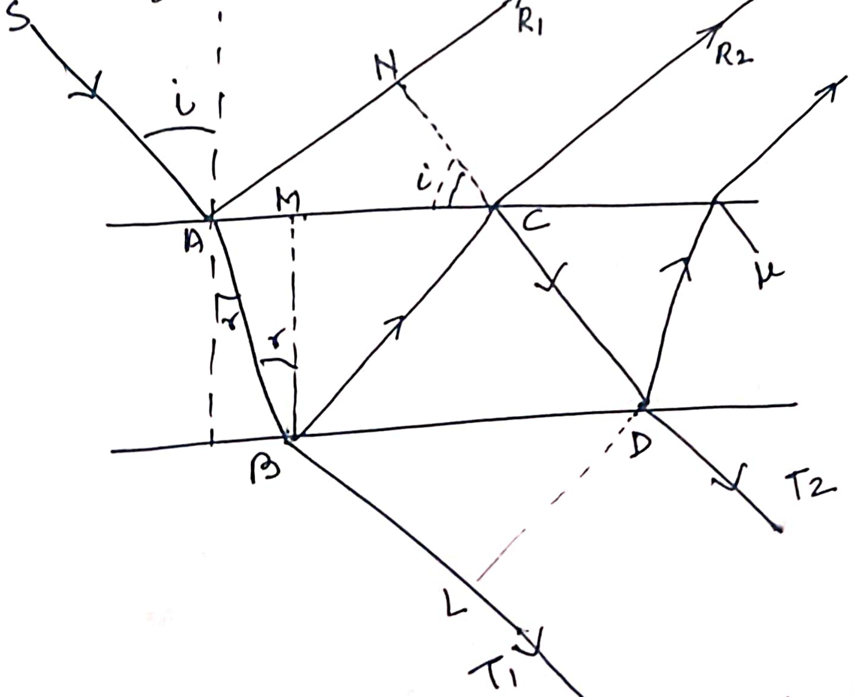
TITLE : - TWO beam Interference By division of Amplitude

Interference by thin flim :-

When a flim of oil spread over surface of water viewed by white light reflected from it, brilliant colour are often seen. A similar colour phenomenon is obtained from the bubble of from the thin glass plates. These colour arise due to interference between the light waves reflected from the upper and lower surfaces of the flim, or the plate.



Interference of light by parallel sides thin flim

Let a parallel sides thin flim of reflective index and thickness t' be considered within an angle i on parallel-sided transparent thin flim of thickness t refractive index, μ > 1

At A is reflect partly along AR_1 and partly along AB at angle r.

SA → A beam of light of amplitude 'a' incident on the upper surface of the flim.

AR_1 → Light reflected from the upper surface of the flim.

AB = Light transmitted into the flim through the upper surface.

BC = Light reflected from the lower surface of the flim.

BT_1 = Light transmitted outside the flim through the lower surface

CR_2 = Light transmitted outside the flim through the upper surface

CD = Light re-reflected into the flim at the point C

The reflection coefficient of the flim surfaces being high it can be assumed that the amplitude becomes insignificant after two reflections and hence subsequent reflections inside the film can be ignored.

NC and DL are perpendicular drawn from C and D

BM is the perpendicular drawn from C on BD.

Δ = path ABC in film path AN in air.

$$= \mu(AB+BC) - AN \quad \text{——— (1)}$$

Now $AB = BC = \dfrac{BM}{\cos r} = \dfrac{t}{\cos r}$

and $AN = AC \sin r$

$$= (AM+MC)\sin r$$

$$= (BM \tan r + BM \tan r)\sin r$$

$$= 2r \tan r \sin i$$

$$= 2t \frac{\sin r}{\cos r}(\sin i) = 2t\frac{\sin r}{\cos r}(\mu \sin r) \quad [\sin i = \mu \sin r]$$

$$= 2\mu t \frac{\sin^2 r}{\cos r}$$

Substituting the value of AB, BC and AN in (1)

$$\Delta = \mu\left(\frac{t}{\cos r} + \frac{t}{\cos r}\right) - 2\mu t \frac{\sin^2 r}{\cos r} = \frac{2\mu t}{\cos r}(1-\sin^2 r) = 2\mu t \cos r$$

The ray AR_1 having suffered a reflection at the surface of the a denser medium undergoes a phase change of π which is equivalent to path difference $\lambda/2$

Effective path diff bet AR_1 and CR_2 is $\boxed{2\mu t \cos r - \lambda/2}$