PHYSICS
Chapter - Optics

B.SC (Sem-IV)
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TOPIC :- Nature of fringes obtained in Fabry-perot-Interferometer :-

The condition for maximum is given by

$$2d\cos\theta = n\lambda$$

Where n is an integer. Width d, λ and n are constant for a given order, θ must be constant. Thus all points of max^m intensity will lie on a circle. LM is the focal length plane of the lens between B and LM to focus the fringes since there will be several values of θ for which n is an integer, the maximum are concentric circles or rings seperated by comparatively wider concentric minima.

If r be the radius of a bright rings, we have

$$\cos\theta = \frac{f}{\sqrt{f^2+r^2}}$$

where f is the focal length of the lens.

$$2d\frac{f}{\sqrt{f^2+r^2}} = n\lambda \quad \text{where n is the order of th}$$

$$n = 2d\frac{f}{(f^2+r^2)^{1/2}h} \simeq \frac{2d}{\lambda}\left(1-\frac{r^2}{rf}\right)$$

As n changes with θ

$$dn = -\frac{2d}{\lambda}\cdot\frac{r}{f^2}dr$$

The negative sign shows that as θ increase. The order of rings decrease. Max angle. The max. value of the order is at the centre of the system.

Also since $2d\cos\theta = n\lambda$

$$n = \frac{2d}{\lambda}\cos\theta$$

$$dn = \frac{2d}{-\lambda}\cdot \sin\theta\, d\theta$$

Hence as θ increases, the order of the rings decrease

Thus the order of the second fringes is given by

$$(n-1)\lambda = 2d\cos\theta'$$

Both the expressions give a result opposite to that of Newton's rings in which the order of the ring increases with the angle of incidence and the order of the first rings is given by

$$(n+1) = 2d\cos\theta$$

By making d large a very high order of fringes may be observed. The fringes are obtained with monochromatic light.

Also if $dn = -1$, $d\theta = \frac{\lambda/2}{2\pi d}$

Hence the concentric fringes are closer together for large radii and near the centre the fringes are widely seperated. The smaller the value of d the broader and more widely seperated are the fringes. If White light is used, the bright rings of shorter wavelength are closer together than of longer wavelength.