Assignment-5

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Ques-1 ans a) A coherent source emits light wave with the same frequency, wavelength and phase. when these waves superimpose, they create sustained interference pattern with fixed position for maxima and minima.

example: laser, which produce highly coherent light.

ans b) when monochromatic light is used in Newton's ring experiment, the rings appears as alternating bright and dark circles centred at the point of contact b/w the two surfaces. However, if white light is used, the interference pattern becomes colourful, with veiled at the inner edge remains dark due to the superpositions of rings formed by different wavelengths.

Ques-2 ans a) Two independent source cannot produce ~~coherent~~ sustained interference pattern, because, they lack coherence for interference to occur the waves from both source must have the same frequency, wavelength and phase. Incoherent sources emit waves with varying properties, preventing consistent constructive or destructive interference.

example:- Lasers, while typical lamps are incoherent.

ans b) The centre of Newton's Ring is a reflected system appears dark due to destructive interference. when light reflects from the upper surface of a plane convex lens and the lower surface of a float glass plate, the path difference b/w the reflected rays varies at the center, the path difference is an odd multiple of half the wavelength causing destructive interference and resulting in a dark spot.

Ques-3 ans a> Extended sources, like slits or gratings. cur
defined interference pattern. These patterns result from the superposition of waves from different parts of the source. Coherent light from extended. Sources produces clear fringes.
example → Youngs double slit experiment.

ans b> Newton's ring refer to an interference pattern created by the reflection of ~~light~~ light b/w two surfaces: a ~~spe~~ spherical surface and an adjacent flat surface, when viewed with monochromatic light, then rings appears as concentric alternating Bright and dark. rings centered at the point of contact b/co the two surfaces. However when viewed with white light, they form a concentric ring pattern of rainbow due to different wavelength interfering, at varying air layer thickness between the surfaces.

Ques-4 ans a> when a light number of evenly spaced parallel slit (such as in diffraction grating) are used the diffraction pattern exhibits specific changes.

1. Narrower Maxima:- The principal maxima become very narrow due to the large number of slits. Then sharp maxima result from the super position of ~~light~~ light wave from numerous slits.

2. Bright Principle Maxima: intensity increases significantly.
3. Vanishing secondary Maxima: intensity decreases as $\frac{1}{N^2}$

ans b> Rayleigh's ~~and~~ criterion says two tiny objects are just barely separate if the center of one's blurry light pattern hits the dark ring of the other's. Bigger lenses and shorter wavelengths mean sharper images and better resolution.

$$\theta = 1.22 \frac{\lambda}{D}$$

$\theta \rightarrow$ angular separation
$\lambda \rightarrow$ in wavelength of light
$D \rightarrow$ diameter of aperture.

Q-5 ans a) The dispersive power of a plane transmission grating refers to its ability to separate different wavelength of light. specially it's defined as the ratio of the difference in the angle of differaction b/w any two neighbouring spectral lines to the difference in wave lengths corresponding to those lines.

$$\text{dispersive power} = \frac{\Delta\theta}{\Delta\lambda}$$

$\Delta\theta \rightarrow$ change in angle in diffraction

$\Delta\lambda \rightarrow$ change in wavelength of light.

ans b) i) Central Maximum: The central maximum remains at the centre of the diffraction pattern. This is where most of the light is concentrated.

ii) Secondary Maxima and Minima: around the central maximum, you will see alternating bright and dark region. There are secondary maxima and minima. The intensity of light decreases as you move away from the central maximum.

iii) Angular Spreading: The angular width of the central maximum increases on the slit size decreases. In other word, the central peak become Broader.

iv) Intensity Distribution: The intensity of light in the secondary maxima decreases as you move away from the central maximum.