

Notes:-

1. Answer **all five** questions from **Section A**, **Any three** from **Section B** and **Any three** from **Section C**.
2. All questions of a particular section should be answered collectively at one place.
3. Answer should be to-the-point and whatever required supplemented with neat sketches.
4. Any missing data may be assumed suitably giving proper justification.
5. Figures on the right-hand side margin indicate marks.

Section-A**Attempt all five questions.****1 × 5 = 5 Marks**

- (I) What is principle of superposition?
- (II) What happens when the monochromatic source of light is replaced by white light source in Fresnel's biprism experiment?
- (III) In Newton's ring experiment, a dark spot is obtained at point of contact in reflected light. Explain why?
- (IV) Define unpolarised and plane polarised lights.
- (V) If the acceptance angle of an optical fibre is 45° , find the numerical aperture.

Section-B**Attempt any three questions.****2 × 3 = 6 Marks**

- (I) Define the coherent sources? Two coherent sources of intensity ratio α^2 interfere. Prove that in the

Interference pattern,
$$\frac{I_{\max} + I_{\min}}{I_{\max} - I_{\min}} = \frac{\alpha^2 + 1}{2\alpha}$$

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- (II) The inclined faces of a prism ($\mu = 1.5$) make an angle of 1° with the base of the prism. The slit is 15 cm from the biprism and is illuminated by light of $\lambda = 6000 \text{ \AA}$. Find the fringe width at a distance of 1 m from the biprism.

- (III) A tube 30 cm long filled with a solution of 15 gm of cane sugar in 100 cc of water is placed in the path of polarized light. Find the angle of rotation of plane of polarization if the specific rotation of cane sugar is $66 \text{ deg (dm)}^{-1}(\text{gm/cc})^{-1}$.

- (IV) Find the acceptance angle and critical angle of an optical fibre if the refractive indices of the material of core $\mu_1 = 1.50$ and of cladding layers $\mu_2 = 1.45$.

Section-C**Attempt any three questions.****3 × 3 = 9 Marks**

- (I) Obtain the expressions for the positions of bright and dark fringes formed due to the superposition of light waves coming from two coherent monochromatic sources. Using one of these expressions find the formula for the fringe width.

- (II) Show that in Newton's rings experiment in reflected light diameters of the bright rings are proportional to the square root of odd natural numbers & that of dark rings are proportional to the square root of natural numbers?

- (III) Give Fresnel's theory for rotatory polarization and derive a formula for the optical rotation produced by quartz.

- (IV) Define acceptance angle of an optical fibre. Obtain an expression for acceptance angle of an optical fibre for which the refractive indices of the material of core and cladding layers are μ_1 and μ_2 respectively.