DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 7

Topic :- WAVE OPTICS

1 **(a)**

The number of fringes shifting is decided by the extra path difference produced by introducing the glass plate. The extra path difference is $(\mu - 1)t = n\lambda$

Or $(1.5 - 1) \times 0.1 \times 10^{-3} = n \times 500 \times 10^{-9}$

$\Rightarrow n = 100$

2 **(b)**

The rings observed in reflected light are exactly complementary to those seen in transmitted light. Corresponding to every dark ring in reflected light there is a bright ring in transmitted light. The ray reflected at the upper surface of the air-film suffers no phase change while the ray reflected internally at the lower surface suffers a phase change of π.

3 **(d)**

$\lambda = 600 \text{ nm} = 6 \times 10^{-7}\text{m}$

$a = 1 \text{ mm} = 10^{-3}\text{m}, D = 2 \text{ m}$

Distance between the first dark fringes on either side of central bright fringe=width of central maximum

$$= \frac{2\lambda D}{a} = \frac{2 \times 6 \times 10^{-7} \times 2}{10^{-3}}$$

$$= 24 \times 10^{-4}\text{m} = 2.4 \text{ mm}$$

4 **(a)**

$\mu_v = 1$ and $\mu_a = 1.003$

$$\therefore \quad \frac{\lambda_v}{\lambda_a} = \frac{\mu_a}{\mu_v} = 1.0003$$

$x = \lambda_v n = \lambda_a (n + 1)$

$$\frac{n+1}{n}=\frac{\lambda_v}{\lambda_a}=1.0003$$

$$1+\frac{1}{n}=1.0003, \frac{1}{n}=0.0003$$

$$n=\frac{1}{0.0003}=\frac{10^4}{3}$$

$$\therefore \; x=\lambda_a n=6000\times 10^{-7}\text{mm}\times\frac{10^4}{3}=2\text{ mm}$$

5 **(c)**

Limit of resolution of the telescope

$$a=\frac{1.22\lambda}{a}=\frac{d}{x}$$

Or $d=\frac{1.22\lambda\, x}{a}$

$$=\frac{1.22\times 5\times 10^{-7}\times 8\times 10^{16}}{0.25}=1.95\times 10^{11}\text{m}$$

6 **(d)**

$$v=\frac{c}{\sqrt{\mu_r\varepsilon_r}}=\frac{3\times 10^8}{\sqrt{1.3\times 2.14}}=1.8\times 10^8 m/s$$

7 **(b)**

Fringe width $(\beta)\propto\frac{1}{\text{prism Angle }(\alpha)}$

8 **(a)**

Angular spread on either side is $\theta=\frac{\lambda}{a}=\frac{1}{5}$ rad

9 **(a)**

Photoelectric effect explain the quantum nature of light while interference, diffraction and polarization explain the wave nature of light

10 **(b)**

$$\beta=\frac{\lambda D}{d}=\frac{6000\times 10^{-10}\times 2}{4\times 10^{-3}}$$

$$=0.3\times 10^{-3}\text{m}=0.3\text{mm}$$

12 **(a)**

If maximum electron density of the ionosphere is $N_{\max}$ per m^3 then the critical frequency f_c is given by $f_c=9(N_{\max})^{1/2}$

$\Rightarrow 10\times 10^6=9(N)^{1/2}\Rightarrow N=1.2\times 10^{12}m^{-3}$

13 **(d)**

Phase difference $=\frac{2\pi}{\lambda}\times$ path difference

ie, $\phi=\frac{2\pi}{\lambda}\times\frac{\lambda}{6}=\frac{\pi}{3}$

As, $I=I_{\max}\cos^2\left(\frac{\phi}{2}\right)$

Or $\frac{I}{I_{\max}}=\cos^2\left(\frac{\phi}{2}\right)$

Or $\frac{I}{I_0}=\cos^2\left(\frac{\pi}{6}\right)=\frac{3}{4}$

14 **(c)**

Two coherent source must have a constant phase difference otherwise they can not produce interference

15 **(d)**

$$\beta=\frac{\lambda D}{d}=\frac{600\times10^{-9}\times2}{1\times10^{-3}}=12\times10^{-4}\text{ m}$$

So, distance between the first dark fringes on either side of the central bright fringe

$X=2\beta$

$=2\times12\times10^{-4}$ m

$=24\times10^{-4}\text{ m}=2.4$ mm

16 **(a)**

As the two bright fringes coincide

$\therefore\ n\lambda_1=(n+1)\lambda_2$

$$\frac{n+1}{n}=\frac{\lambda_1}{\lambda_2}=\frac{7500}{6000}=\frac{5}{4}$$

$$1+\frac{1}{n}=\frac{5}{4}, n=4$$

17 **(a)**

When spherical waves are incident on a plane refracting surface, separating two media, the reflected waves have spherical wave fronts

18 **(d)**

Refractive index of a medium

$n=\tan i_p$

Where $i_p=$ Brewster's angle

$\Rightarrow i_p = \tan^{-1}[n]$

19 **(a)**

$\beta \propto \lambda, \therefore \lambda_v =$ minimum

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	B	D	A	C	D	B	A	A	B
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	A	D	C	D	A	A	D	A	C