KEC

K Education Centre

AS Waves and Optics -2

Refraction ,Critical angle , interference and diffraction

Assignment Questions

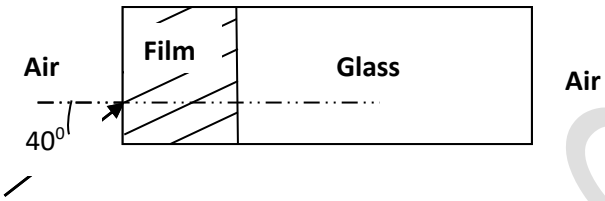
Waves and Optics -2 :

Q1 : A window pane made of a glass of refractive index 1.55 is covered with on one side only with a transparent film of refractive index of 1.40.

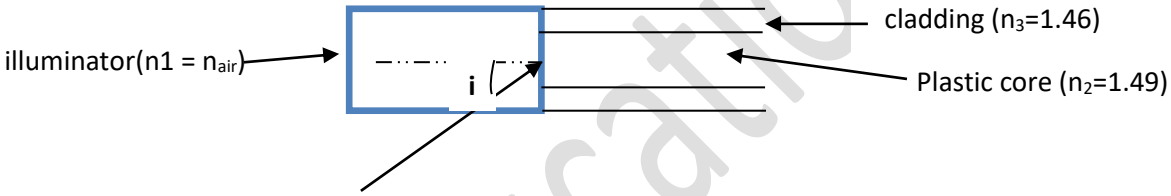
a) Calculate the critical angle of the film glass boundary.

b) A light ray is directed at the film at angle of incidence of 40^0 as shown in figure below.

i) Calculate the angle of refraction in the film. ii) the angle of refraction of rays when it leaves the pan.



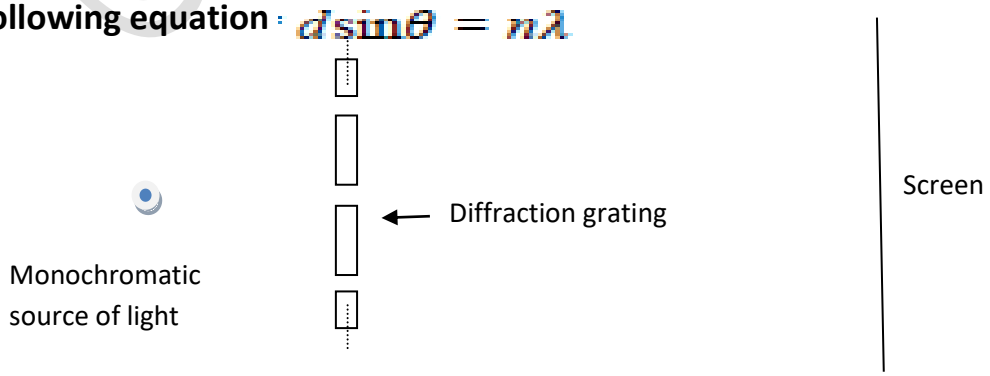
Q2 : Optical fibre work by using total internal reflection, a fibre-optic illuminator is used to transmit light rays into optical fibres as shown in figure.



a) Light travelling in the fibre's plastic core is incident on the core's boundary with the cladding. Calculate the critical angle at this boundary.

b) Figure above shows a ray of light incident at angle i on the illuminator core boundary. When this ray reaches the core-cladding boundary it undergoes total internal reflection. Calculate maximum possible value of i .

Q3 : When monochromatic light is passed through a diffraction slit an interference pattern is formed on distant screen. The maxima of interference pattern obey the following equation : $d\sin\theta = n\lambda$



where d is the separation between adjacent slits on diffracting grating , θ is the angle through which light is diffracted , n is the order of maximum.

a) Derive this formula using figure.

b) The diffraction grating is stated to have 500 lines per mm. Light arriving at the interference pattern's second order maxima has been diffracted through 25^0 . Calculate the wavelength of the light.

Q 4: A solution has a refractive index of 1.35.

a) Calculate the speed of electromagnetic waves in the solution.

b) Laser light with a frequency of 5×10^4 Hz passes from this solution into air. Calculate the change in the wavelength of laser light.

Q5 : Light of wavelength 430 nm is directed normally at a diffracting grating. The first order maxima has been diffracted through 28^0. Calculate :

a) The number of slits per mm on grating.

b) The angle of diffraction for each of the other diffracted orders of the transmitted light.

Q6 : Light directed normally at a diffracting grating contains wavelengths of 580 and 586 nm only. The grating has 600 lines per mm.

i) How many diffracted orders are observed in the transmitted light ?

ii) For the highest order , calculate the angle between the two diffracted beams.