K Education Centre

AS Revision

Waves and Optics -2 marking scheme

Marking scheme

	Guidance/Comments/Formulas	Marks
Q1:	a) Using sin n_c $=n_2/n_1$ = $\sin^{-1}$(1.40/1.65) = 65 degrees b) i) n =sin i /sin r r = $\sin^{-1}$ (sin40/1.40) = 27.34 degrees ii) From film to glass $n_1$sin i = n_2 sin r ; r = $\sin^{-1}$(1.40 sin27.34 / 1.55) = 24.50 degrees From glass to air $n_1$sin i = n_2 sin r ; r = $\sin^{-1}$(1.55 x sin24.50/1) = 45 degrees	2 2 4
Q2	a) sin $\emptyset_c$ = n_3/n_2 = $\sin^{-1}$(0.979) = 78.5 degrees b) The maximum possible value of *i* occurs when ray is incident on core/cladding boundary at critical angle. Since r and $\emptyset_c$ are angles in right angle triangle r = 90 - $\emptyset_c$ = 11.5 degrees Using snell's law $n_1$sin i = $n_2$sinr ; i = $\sin^{-1}$0.297 = 17.3 degrees	3 4
Q3	a) For derivation see the class notes b) Calculate slit separation d = (1x 10^{-3})/500 = 2x 10^{-6} m Calculate wavelength using d sin $\emptyset = n\lambda$ $\lambda = (2 \times 10^{-6} \times \sin 25) / 2 = 4.23 \times 10^{-7}$ m	2 3
Q4	a) Using $n_s = c/c_s$; c_s = 3 x10^8 / 1.35 = 2.22 x10^8 m/s	2

	b) For solution, Using $\lambda_s = c_s / f = (2.22 \times 10^8) / (5 \times 10^{14}) = 4.44 \times 10^{-7}$ m For air , $\lambda = c/f\ (3 \times 10^8)/(5 \times 10^{14}) = 6 \times 10^{-7}$m Change in wavelength = $\lambda_s - \lambda = 1.55 \times 10^{-7}$m	4
Q5	a) Using $d \sin \emptyset = n \lambda$ number of slits per mm = 1090 b) Angle of other diffracted order = 69.9 degrees	2
Q6	i) Using $d \sin \emptyset = n \lambda$ $d = 1/N = 1/600 = 1 \times 10^{-3}/600 = 1.66 \times 10^{-6}$ For highest order $\emptyset = 90$ degrees or $\sin\emptyset = 1$ For first wavelength $n = 1.66 \times 10^{-6} / 580 \times 10^{-9} = 2$ also for second wavelength $n = 1.66 \times 10^{-6} / 586 \times 10^{-9} = 2$ ii) For 580 nm wavelength $\emptyset = \sin^{-1}(2 \times 580 \times 10^{-9} / 1.66 \times 10^{-6}) = 44.33$ degrees For 586 nm wavelength $\emptyset = \sin^{-1}(2 \times 586 \times 10^{-9} / 1.66 \times 10^{-6}) = 44.91$ degrees Angle difference $= 0.58$ degrees	4