College of Engineering, Pune
EndSemester Examination-Nov-Dec 2013

Subject : Physics for sem I Timing : 3 h
Academic Year : 2013–14 Max. marks : 60

Instructions:
1.Solve any four questions
2.Figures to the right indicate full marks

Given constants:c = 3 x 10^8 m/s, mass of electron = 9.1 x 10^{-31} kg, mass of neutron = 1.676 x 10^{-27} kg, k= 1.38 x 10^{-23} J/K, h = 6.626 x 10^{-34}Js

Q.1.a)Prove that linearly polarized light can be considered as a resultant of two opposite circularly polarized vibrations of same frequency but of half the amplitude 5M

b)The wave function of a certain particle is $\Psi(x) = A\cos^2 x$ for $0 \leq x \leq \Pi/2$. 6M
(i)Find the value of A
(ii)Find the probability that the particle be found between x = 0 and x = $\Pi/4$

c) A grating 9600 lines uniformly spaced over a width W = 3 cm and is illuminated by light from a mercury vapor discharge. (a) what is the expected dispersion, in the third order, in the vicinity of intense green line (λ = 546 nm), (b) what is the resolving power of this grating in fifth order. 4M

Q.2.a) Derive the condition for resultant intensity in case of multiple slit diffraction and find the conditions for principal maxima and minima. 6M

b) Calculate energy released by fission of 20gm of $_{92}U^{235}$ in KWh, Given that energy released per fission is 200MeV 5M

c) Derive the Einstein's relations in thermal equilibrium condition 4M

Q.3.a) Explain the principle construction and working of Semiconductor diode laser. 5M

b) An analyser examines two adjacent plane polarized beams A and B whose planes of polarization are mutually perpendicular. At one position beam B shows zero intensity, from this position if analyzer is rotated by 30^0 then intensities of beams are found to be equal. Determine the ratio of incident intensities of the beams A and B. 4M

c) How can we experimentally distinguish between plane polarized, circularly polarized, elliptically polarized and partially polarized light. 4M

d) What is the smallest possible uncertainty in the position of an electron moving with velocity 10^6m/s.
2M

Q.4.a) An electron is trapped in an infinitely deep potential well 3 A^O in length, if the electron is in ground state, what is the probability of finding it within 1A^O of the left hand wall? 5M

b) In newtons ring experiment, the diameters of the 4^{th} and 12^{th} darks rings are 0.4 cm and 0.7 cm respectively. Find the diameter of 20^{th} dark ring. 4M

c) Obtain an expression for fringe width, wedge angle and spacer thickness in interference pattern of wedge shaped film. 6M

Q.5.a) Consider the wave function of a particle

$\psi(x) = (1 - x^2 / a^2)$ for $0 \leq x \leq a$

Normalise the wavefunction, and find the expectation value of the position. 6M

b) Expalin principle, construction and working of Cyclotron. 5M

c) A particle travelling with energy $E > V_0$, has a potential barrier defined as 4M

$V = 0$	$x < 0$
$V = V_0$	$0 \leq x \leq a$
$V = 0$	$x > a$

Write the Schrödinger's wave equations and its solutions for all the three regions

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