

8. (a) Find out the eigen functions and represent them graphically for a particle with in an one dimensional box of width a . 6

- (b) What do you mean by quantum mechanical tunneling? Give two examples of it. 4

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BS 1102 (Old) /BSCP 2101 (New)

Second Semester Examination – 2010

PHYSICS – I

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

The figures in the right hand margin indicate marks for the questions.

1. Answer the following questions : 2×10
- (a) What is logarithmic decrement ? Find the ratio of n th amplitude with 1st amplitude in case of under damped oscillation.
- (b) In a damped harmonic oscillator, the damping force is proportional to the velocity, mention the positions at which

- (i) the damping force vanishes;
 - (ii) the restoring force vanishes.
- (c) Ten sinusoidal waves of equal amplitude superpose incoherently to produce a resultant wave of intensity 0.5 watt/m^2 . What would be the resultant intensity if the waves superpose coherently.
- (d) Write down the conditions for clear vision of interference fringes.
- (e) What are the factors on which amplitude at a point due to a wave front depends upon in case of Fresnel Diffraction?
- (f) Light from a monochromatic source of wavelength 4000\AA is incident on a grating having 5000 rulings /cm. The spectrum is focused on a screen by a lens of focal

length 2m. Find the linear distance on the screen at which the 1st order maxima will be observed.

- (g) The refractive index of glass is 1.54. Find the polarizing angle when light passes from glass to air medium?
- (h) Write down the Maxwell's electromagnetic wave equations both in differential form.
- (i) The wave function which is in quantum states $\phi_1, \phi_2, \phi_3, \phi_4$ and ϕ_5 is given by,

$$\psi = \frac{1}{\sqrt{3}}\phi_1 + \frac{1}{\sqrt{3}}\phi_2 + \frac{1}{\sqrt{6}}\phi_3 + \frac{1}{\sqrt{24}}\phi_4 + \frac{1}{\sqrt{8}}\phi_5$$
 what is the probability of the system being in the state given by ϕ_5 and what is the total probability?
- (j) Write the Schrödinger's time independent wave equation for a free particle of mass 'm' moving along Y axis.

2. (a) What do you mean by normal mode oscillation? Compare between Q_1 and Q_2 mode oscillations. 2+3
- (b) Differentiate between progressive and stationary wave. 3
- (c) Two identical strings A & B of equal mass are attached with weights 5kg and 10kg respectively. Find out the ratio of the speed of transverse wave passing through them. 2
3. (a) In case of Young's double slit experiment if the yellow light is replaced by red light then how the fringes are effected? 2
- (b) Find out the expression for diameter of dark ring in Newton's ring Experiment and explain how the wavelength of a monochromatic light can be measured by it. 5

- (c) In a Newton's ring experiment the diameter of n th ring is 0.46 cm it got shrink to a diameter of 0.40 cm when a liquid is introduced between the Plano-convex lens and plane glass plate. Find the refractive index of the liquid. 3
4. (a) Graphically show how the amplitude varies with order of Fresnel's half period zones. 2
- (b) Differentiate Zone plate from Convex lens. 4
- (c) A zone plate is constructed in such a way that radii of the zones are same as that of Newton's rings formed in reflected light with radius of curvature of Plano convex lens 1cm. Find the principal focal length of the zone plate. 2
- (d) If in a grating there are 6000 lines/cm, then what is the highest order spectra that can be obtained from it. 2

5. (a) If the width of opaque space is equal to that of transparent space in a plane transmission grating, then which order spectra will be absent ? 2
- (b) A light is examined by a rotating Nicol showed no variation of intensity. What is the state of polarization ? 2
- (c) What is Brewster's law ? Using this show that the reflected and transmitted rays in a glass slab are perpendicular to each other. 6
6. (a) The maximum value of electric field in an electro magnetic wave is 800V/m. Find the maximum value of magnetic intensity and the average value of poynting vector. 3

- (b) What is Faraday's law of electromagnetic induction ? Find out its differential form. 5
- (c) Distinguish between conduction current and displacement current. 2
7. (a) Derive the equation for an electromagnetic wave travelling in a charge free conducting medium in terms of electric field vector. 4
- (b) The normalized wave function for certain particle is $\psi(x) = \sqrt{\frac{3}{\pi}} \cos x, -\frac{\pi}{2} < x < \frac{\pi}{2}$. Calculate the probability of finding the particle between $0 < x < \frac{\pi}{4}$. 3
- (c) The photoelectric threshold of tungsten is 2300 \AA . Determine the energy of the electrons ejected from the surface by ultraviolet light of wavelength 1800 \AA . 3