Registration no: | | | | | | | | | | |

Total Number of Pages: 02

B.Tech
BS1102

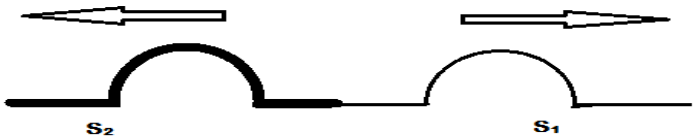
2nd Semester Back Examination 2015-16
PHYSICS - I
Branch: ALL
Time: 3 Hours
Max Marks: 70
Q.CODE: W624

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) If the total energy of simple harmonic oscillator is 0.8 ergs, find its kinetic energy at the mean position and extreme position.

b) A uniform string S_1 is connected with another uniform string S_2, whose linear mass density is greater than that of S_1. A wave pulse propagating along one string meets the other at the junction where a part is transmitted and a part is reflected back, as shown in figure. Find out in which string the wave propagated initially.



c) In a plane diffraction grating, if the width of opaque space is equal to the slit width, find the orders of missing spectra.

d) In a Newton's ring arrangement, the diameter of a bright ring is 0.5 cm. What would be the diameter of the same bright ring if radius of curvature of Plano convex lens becomes twice the initial value?

e) Evaluate curl of the vector field $\vec{A} = 2x^2y\hat{\imath} + y^3\hat{\jmath} + 3xyz\hat{k}$.

f) Distinguish between displacement current and conduction current.

g) If the probabilities of finding a particle in four different eigen states φ_1, φ_2, φ_3 and φ_4 are 1/3, 1/5, 1/2 and 1/7 respectively, write the wave function of the particle.

h) What is stopping potential and how it is related to incident radiation.

i) Write the time dependent and time independent Schrodinger equations for a free particle of mass 'm' moving along Y-axis.

j) One electron and one proton are moving with same kinetic energy. Find the ratio of their de Broglie wave length. Their masses are 9.11×10^{-31} kg and 1.67×10^{-27} kg respectively.

Q2 **a)** Two identical simple pendulums are suspended in vacuum and the masses are connected by a mass less spring of low spring constant. Set up the differential equation for this coupled system in normal co-ordinates. Show that the normal mode of higher frequency describes the out-of-phase mode of oscillation. **(6)**

b) The time period of simple harmonic oscillator is 4 s. It is subjected to a damping force proportional to its speed with damping coefficient $0.1sec^{-1}$. Find the time period and logarithmic decrement of damped oscillation. **(4)**

Q3 **a)** Prove with necessary diagram that the diameters of the dark rings, in Newton's ring experiment, as obtained by reflected light are proportional to square root of natural numbers**.** **(4)**

b) In a Newton's ring system, the diameters of the 5^{th} and 10^{th} dark ring are 0.122cm and 0.150cm respectively. What is the diameter of the 15^{th} dark ring? **(3)**

c) Quartz has refractive indices 1.55 and 1.54. Calculate the thickness of the quarter wave plate for sodium light of wavelength $5893A^0$. **(3)**

Q4 **a)** In Fraunhofer diffraction due to single slit, obtain the conditions for principal maximum, secondary maxima and minima. Show the distribution of intensity in this diffraction pattern. **(5)**

b) Distinguish between unpolarised, plane polarised, circularly polarised and elliptically polarised light. **(5)**

Q5 **a)** State and prove Poynting theorem. Explain how the Poynting vector explains energy flow? **(4)**

b) State Ampere's circuital law and obtain its differential form with Maxwell's modification. **(3)**

c) Calculate the value of $\vec{\nabla}.(r^3\vec{r})$ where, r is a position vector. **(3)**

Q6 **a)** Derive the wave equation in terms of scalar potential and vector potential. **(6)**

b) A parallel plate capacitor having circular plates of radius 6.5 cm is being charged. calculate the displacement current if the rate of change of electric field between the plates is $2.2x10^{10}V/ms$. **(4)**

Q7 **a)** Using Heisenberg's uncertainty principle, show that the ground state energy of harmonic oscillator is non zero. **(5)**

b) Explain Compton scattering and obtain the expression for Compton shift. **(5)**

Q8 **a)** Set up the Schrodinger's wave equation for particles of mass m each crossing a potential step, **(6)**

$V(x) = 0$ for $x < 0$

$= V_0$ for $x \geq 0$ from left. Obtain the solution. Indicate the reflected and transmitted part in it. (Consider the energy 'E' of the particle $> V_0$).

b) If the wave function of a moving particle $\Psi(x) = A_n \sin 2n\pi x / L$ is normalized in $0 \leq x \leq 1$, find the value of normalisation constant then write the normalised wave function. **(4)**