Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech
BS 1102

First Semester Regular Examination – 2014

PHYSICS – I

BRANCH : B. TECH

QUESTION CODE : H 453

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.

1. Answer the following questions : 2 ×10

(a) The amplitude of a forced damped oscillator is 1.2 cm. What would beits amplitude if the magnitude of the driving force is doubled ?

(b) What is sharpness of resonance ?

(c) Two waves of same frequency have amplitudes 2 units and 3 units respectively when they superpose coherently the intensity of the resultant wave is I_1. The intensity becomes I_2 when they superpose incoherently. Find the ratio $\frac{11}{12}$.

(d) In a Newton's ring arrangement, the diameter of a bright ring is 0.5 cm. What would be the diameter of the ring if the lens placed by another one having double the radius of curvature ?

(e) Write down Schrodinger's time dependent and time independent equations for the particle.

(f) A particle is in a one – dimensional infinitely deep potential well of width L. Graphically show the dependence of ground state energy on the width of the well.

(g) The allowed values of energy of a quantum mechanical system are E_1, E_2, E_3 and E_4 with probabilities 0.2, 0.1,0.4, and 0.3 respectively. Find the expectation value of energy for the system.

P.T.O.

(h) Write the differential and integral form of Faraday's law.

(i) Write Planck's formula for spectral distribution of black body radiatio.

(j) State Poynting theorem.

2. (a) Define forced vibration. Write down the equation of forced vibration and solve the equation of motion. 4

(b) Establish the condition for amplitude resonance and explain the sharpness of amplitude resonance. 3

(c) Two simple pendulums of mass m and length l each are coupled by a spring of force constant k. Write the expression for angular frequency of normal modes of vibration of the coupled system. 3

3. (a) With the help of a suitable ray diagram, describe the production of Newton's rings. 3

(b) A transmission grating has 8000 rulings per cm. The first order principal maximum due to monochromatic source of light occurs at an angle of 30°. Determine the wavelength of light. 2

(c) Explain the Fraunhoffer diffraction at a single slit and hence find the conditions for maxima and minima. 5

4. (a) Describe the construction of a zone plate. How does the primary focal length of a zone plate depend on the wavelength of light used ? 5

(b) In Newton's ring experiment in laboratory source of light having two wavelengths 6000 A° and 4500 A° is used. It is found that nth dark ring due to 6000A°coincides with the (n +1)th dark ring due to 4500 A°. Calculate the radii of nth dark rings due to 6000 A° and 4500 A° if radii of curvature of the plano-convex lens is 100 cm. 3

(c) What are the characteristic of grating spectra ? 2

5. (a) What is half wave plate ? Derive an expression for its minimum thickness for a given wavelength in terms of its refractive indices for O – ray and E –ray. 5

(b) State Brewster's law. Show that when light travelling in one transparent medium, meets another transparent medium at the polarizing angle, the reflected and transmitted rays are perpendicular to each other. 5

6. (a) Prove the transverse nature of electromagnetic wave mathematically. 4

(b) The maximum value of electric field in an electromagnetic wave is 800 v/m. Find the maximum value of magnetic intensity and the average value of poyinting vector. 3

(c) Derive electromagnetic wave equation in terms of electric vector, when the wave is passing through the vacuum. 3

7. (a) Solve the Schrodinger's time independent equation to find the energy eigen values of a free particle. 4

(b) Writing the Einstein's photoelectric equation, mention the laws of photo-electric effect. 4

(c) Prove that the momentum of a particle in one dimensional well of infinity height is quantized. 2

8. (a) What is double refraction ? Distinguish between ordinary ray and extra-ordinary ray. 5

(b) Give two differences between pair production and pair annihilation. 2

(c) 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