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

Total number of printed pages – 3

B. Tech
BS 1102

Second Semester Regular Examination – 2015

PHYSICS – I

BRANCH(S) : AEIE, AERO, AUTO, BIOTECH, CHEM, CIVIL, CSE, EC, EEE, EIE, ELECTRICAL, ETC, FASHION, IT, MECH, MM, MME, PLASTIC

QUESTION CODE : J 292

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) Write down the equation of motion of a forced oscillator ?

   (b) What is logarithmic decrement ?

   (c) Find the speed of a longitudinal wave propagating in a medium of density 6×10^3 kg / m^3 and bulk modulus 1.2×10^8 N / m^2.

   (d) Distinguish between the interference produced due to division of amplitude and division of wave front.

   (e) Define absent spectra ?

   (f) How do you separate a unpolarised light from circularly polarized light ?

   (g) Define divergence of a vector field in terms of integrals .

   (h) State Stokes theorem.

   (i) Find the wave function for a system represented by the Eigen functions ψ_1, ψ_2, ψ_3 having probabilities ½ ,1/3, 1/6 respectively.

   (j) Set up the time independent Schrödinger equation for a one dimensional harmonic oscillator.

P.T.O.

2. (a) Starting from the differential equation of a damped oscillator, write the solution for under damped oscillatory motion. Graphically show the variation of amplitude with time. Mention the condition for critical damping. 4

(b) The maximum amplitude of forced damped oscillator is 2.5 cm. What will be the maximum amplitude if damping constant and magnitude of driving force are doubled ? 2

(c) Discuss coherent superposition of N waves having same frequency and a constant phase difference between successive waves. 4

3. (a) Describe Fresnel's biprism method for determination of the wavelength of light. 4

(b) In Newton's ring arrangement the radii of n^{th} bright rings with an air film and liquid film are 1.2 mm and 1.0 mm respectively. Calculate the refractive index of the liquid. 3

(c) Show that the radii of the Fresnel's half period zones are proportional to the square root of natural numbers. 3

4. (a) Describe the formation of diffraction pattern due to plane diffraction grating. What particular spectra would be absent if the width of the transparencies and opacities of the grating are equal ? 6

(b) Mention the similarities and differences between a zone plate and a convex lens. 4

5. (a) Describe the construction of a Nicol prism. Explain how it produces polarized light. 6

(b) Critical angle in certain substance is 30°. What is the polarizing angle of the substance ? 4

6. (a) State Poynting theorem. Explain how the Poynting vector explains the energy flow. 5

(b) Derive a relation between magnitudes of electric vector and magnetic vector. 3

(c) Magnetic vector potential for current network is given by $\vec{A} = \hat{i}\, x y^2 + \hat{j}\, yz^2 + \hat{k}\, zx^2$, find the magnetic induction at (1,1,1). Find a unit vector along magnetic induction at this point. 2

7. (a) A wave function $\psi(x)$ is given by $\psi(x) = A_n \sin \frac{2n\pi x}{L}$ in region $0 \leq x \leq L$. Find the normalization constant and normalized wave function. 4

(b) Using uncertainty principle prove that ground state energy of harmonic oscillator is $\bar{h}\omega$. 4

(c) A stream of electrons strike a potential energy step of height 0.04 eV. Calculate the fraction of electrons reflected if energy of the incident electrons is 0.05 eV. 2

8. (a) What is physical meaning of wave function in quantum mechanics ? 4

(b) Find out the eigen functions and represent them graphically for a particle in an one dimensional box of width 'a'. 4

(c) An X – ray beam of wavelength 3 Å is Compton scattered by electrons. Evaluate the Compton shift of a beam scattered at an angle 60°. 2