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

Total number of printed pages – 3

B. Tech
BS 1102

Second Semester Examination – 2013

PHYSICS– I

QUESTION CODE : A 435

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) In a Newton's ring system, the centre is bright. Is the ring system observed in reflected or transmitted light ?

   (b) The diameter of central zone of a zone plate is 0.02cm .The zone plate is illuminated by a monochromatic point source at a distance of 80cm having wavelength 490 nm. Find the position of first two maximas.

   (c) Calculate the KE of an electron having de Broglie wavelength of $1000A^0$.

   (d) Distinguish between quarter wave plate and half wave plate.

   (e) State Gauss Divergence theorem.

   (f) The equation for displacement of a point of a damped oscillator is given by $x = 6e^{-0.35t} \sin (\pi/2)\, t$ m. Find the velocity of the oscillating point at $t = T/4$.

   (g) Give two differences between pair production and pair annihilation.

   (h) State Planck's formula for blackbody radiation. Give the conditions under which Planck's formula reduces to Wein's law.

   (i) Why double refraction cannot occur along optic axis of a crystal.

   (j) Between a photon and an electron of same energy 100 eV, which one has shorter wavelength ?

P.T.O.

2. (a) What is Fresnel's biprism ? Describe the construction of Fresnel's biprism. How the wavelength of unknown light can be measured ? 4

(b) What are Newton's rings ? Describe the necessary theory for the determination of unknown wavelength light. 3

(c) In a Newton's ring experiment with air film the diameter of n^{th} and $(n-5)^{th}$ dark rings are 12.2 mm and 8.1 mm respectively. Find the diameter of $(n+2)^{th}$ dark ring. 3

3. (a) What is Fresnel half period zones ? Show that the amplitude due to the complete wavefront at any point in front of it is just half that due to the first half period zone. 5

(b) Consider a plane diffraction grating of width 4 cm with slit width 0.0001 cm separated by a distance of 0.0002 cm. Wavelength of light used is 5.5×10^{-5} cm. What is the corresponding grating element and the total number of lines in grating ? Find also the highest order of spectrum. 5

4. (a) What are the differences between O-ray and E-ray ? 3

(b) How are unpolarized, plane polarized, circularly polarized and elliptically polarized light distinguished ? 4

(c) Show that the vector field $A = (x^2 + xy^2)\,i + (y^2 + x^2y)\,j$ is irrotational. 3

5. (a) What is Nicol Prism ? Discuss its principle. Discuss Nicol prism as polarizer and analyzer. 3

(b) Show that $\nabla \times \nabla \varphi = 0$. 3

(c) Derive Poynting theorem. Write physical significance of Poynting theorem. 4

6. (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) Electrons cannot stay within the nucleus. Justify by using Heisenberg's uncertainty principle. 3

7. (a) What is the physical significance of wave function ? Write the characteristics of wave function. 4

(b) Show that the ratio of successive amplitude of damped oscillatory motion is constant. 3

(c) Calculate the de-Broglie wavelength associated with an electron moving freely with energy 5 eV. 3

8. (a) Derive time independent Schrodinger's equation for a free particle. 3

(b) The normalized state of a particle represented by the function $\psi = Ne^{-\frac{x^2}{2b^2}+ik_0x}$. Find the constant N. In which region of space the particle is most likely to be found ? 4

(c) Calculate the probability of transmission for a proton of energy 1MeV through a 4 MeV high rectangular potential energy barrier of width 10^{-2} cm. 3