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

Total number of printed pages – 3

B. Tech
BS 1102

Special Examination – 2012

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.

1. Answer the following questions : 2×10

(a) What is the amplitude, wavelength and the velocity of the wave represented by the formula $\varphi(x, t) = 3 \sin (4\pi t - 6x)$ where x, the distance, t, the time are measured in SI units.

(b) How is critical damping useful in practice ?

(c) What difference in fringe pattern will be observed when monochromatic light source is replaced by white light source ?

(d) Compare a zone plate with a convex lens.

(e) Why natural light is unpolarised ?

(f) Explain the Lorentz Gauge condition.

(g) What are the basic postulates of Planck's law of radiation ?

(h) What do you mean by a Blackbody and Blackbody radiation ?

(i) What are the basic postulates of Quantum mechanics ?

(j) What is the physical interpretation of wave function ψ ?

2. (a) What is Quality factor ? Discuss the effect of quality factor on the motion of a under-damped oscillator. 3

b) What is Resonance ? How does the sharpness of amplitude resonance depend upon the damping. Under what condition the amplitude resonance takes place ? 5

(c) What is the physical significance of damping coefficient ? What is its unit ? 2

3. (a) Newton's rings are formed by the light reflected normally from a plane convex lens and plane glass plate with a liquid between them. The diameter of the n^{th} ring is 2.18 mm and that of $(n+10)^{th}$ is 4.51 mm. Calculate the refractive index of the liquid. Given $\lambda = 5893 \overset{0}{A}$ and radius of curvature of lens is 90 cm. 4

(b) Explain why a narrow slit is used for biprism experiment whereas an extended source is used in Newton's rings experiment. 3

(c) What are coherent sources ? How can you produce two coherent sources with the help of biprism ? 3

4. (a) Give the theory of plane transmission grating .How it can be used to find wavelength of light and in what respect determination of wavelength gives better results than those obtained by interference phenomenon ? 6

(b) A beam of monochromatic light when incident normally on a diffraction grating 2500lines/cm. The first order spectral one is observed at an angle 10.18°. Calculate the wavelength of incident light. 4

5. (a) What is Brewster's law ? How it can be used to find polarizing angles in crystals ? 3

(b) What is optical activity ? Discuss the phenomenon of rotation of the plane of polarization of light by optically active material. 3

(c) Starting from Maxwell's electromagnetic equation in free space, obtain Poynting theorem. 4

6. (a) Find the value of Curl(grad f) where $f = 2x^2 - 3y^2 - 4z^2$. 3

(b) Define Stoke's theorem. Applying Stoke's theorem, prove that $\int r.dl = 0$, where r is the position vector. 3

(c) State Maxwll's equation in a medium having no charge and no current. Write two important conclusion of Maxwell's equations. 4

7. (a) Derive electromagnetic wave equation in free space in terms of vector potential and scalar potential. 6

(b) What is Compton effect ? How does it support the quantum nature of radiation ? 4

8. (a) Calculate the normalization constant for a wave function (at $t = 0$), given by

$\psi = Ae^{\frac{[(a]^2 x^2)}{2}} e^{tkx}$

Also determine the probability density. 4

(b) Write Schrodinger equation. In what respect does the Schrodinger equation differ from classical wave equation ? What are the characteristic of Schrodinger's equation. 3

(c) Calculate the probability of transmission of α-particle through a rectangular barrier as described below :

$V_o = 4eV$, $E = 1eV$, width of barrier $= 0.1A°$, Mass of α-particle $= 6.4 \times 10^{-27}$ kg. 3