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

Total number of printed pages – 3

B. Tech
BS 1102

First Semester Back Examination – 2014

PHYSICS – I

BRANCH : AEIE, AERO, AUTO, BIOTECH, CHEM, CIVIL, CSE, EC, EEE, EIE ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, MANUFACT, MANUTECH, MECH, MINERAL, MINING, MME, PLASTIC, TEXTILE

QUESTION CODE : L 350

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) State Heisenberg's uncertainty principle.

(b) What is vector potential ? Write its physical significance.

(c) In a Newton's ring experiment, the diameter of bright rings are proportional to the square root of natural numbers. Are the rings formed by reflected light or transmitted light ? Explain.

(d) Write the condition for amplitude resonance.

(e) Write the boundary conditions satisfied by the quantum mechanical wave function at the boundary between two regions.

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

(g) What is the angle between the plane of polarization and plane of vibration in a plane polarized beam ?

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

(i) Find curl of the position vector.

(j) State the characteristics of grating spectra.

2. (a) Define coupled oscillation. Set up the differential equation for coupled system in normal coordinates. What are their normal mode frequencies ? 4

(b) Explain the terms logarithmic decrement and quality factor with reference to under damped motion and co-relate them. 4

(c) 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

3. (a) Find the resultant amplitude when two waves of same frequency superpose on each other. 3

(b) In a Newton's ring arrangement, the diameter of a bright ring is 0.5cm. What would be the diameter of the ring if the lens placed on the glass plate is replaced by another one having double the radius of curvature ? 2

(c) Derive Poynting theorem. Explain how the poynting vector explains the energy flow. 5

4. (a) Describe the construction and working of a Nicol prism. 5

(b) Distinguish between plain polarized, circularly polarized and elliptically polarized light. 3

(c) Calculate the thickness of double refracting plate capable of producing a path difference of $\lambda/4$ between ordinary and extraordinary ray. Given, $\mu_e = 1.532$, $\mu_o = 1.544$, $\lambda = 6000\ A^0$. 2

5. (a) Describe the formation of diffraction patteren due to plane diffraction grating. Explain the meaning of missing order spectra in the diffraction patteren. 5

(b) Derive the Maxwell's electromagnetic wave equation in terms of magnetic field vector when wave is passing through vacuum. 5

6. (a) Find the wave function for a system represented by the eigen functions Ψ_1, Ψ_2, Ψ_3 having probabilities 1/2, 1/3 and 1/6 respectively. 4

(b) What is potential step ? Explain how quantum physics differ from classical physics in potential step problem. 4

(c) 12 million electrons with energy 3.0 eV are incident on a potential barrier of 9.0 eV high and 0.50 mm width. Calculate how many electrons will tunnel through the barrier. 2

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

(b) Using Heisenberg's uncertainty principle explain the electrons do not exist inside nucleus. 3

(c) Solve the Schrödinger's time independent equation to find the energy eigen values of a free particle. 3

8. (a) Obtain the normalized wave function from the given wave function

$\Psi(x) = A e^{-\alpha x}$ for $x > 0$

$= A e^{\alpha x}$ for $x > 0$

Where α is a positive vector. 4

(b) What is expectation value of a variable in quantum mechanics ? 3

(c) A stream of electrons strike a potential energy step of height 0.04eV. Calculate the fraction of electrons reflected if energy of the incident electrons is 0.05 eV. 3