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

Total Number of Pages : 02

B.Tech
PAP1A102

1st Semester Back Examination 2018-19
APPLIED PHYSICS
BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FAT, IEE, IT, MANUFAC, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PE, PLASTIC, PT, TEXTILE
Time : 3 Hours
Max Marks : 100
Q.CODE : E748
Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right-hand margin indicate marks.

Part – I

Q1 Short Answer Type Questions (Answer All-10) **(2 x 10)**

a) State the principle of virtual work. Give one example. How is D' Alemberts' principle related to this principle?

b) Write the condition for critical damping and give an example for a critically damped oscillator.

c) Find the ratio of maximum intensity and minimum intensity for two waves having amplitude 2 units and 3 units respectively to be constant.

d) Explain the grating element of a diffraction grating.

e) Distinguish between a primitive cell and unit cell.

f) What do you mean by population inversion? Explain briefly how the production of LASER depends on this phenomenon.

g) State Maxwell's equations in a medium having no charge and no current.

h) If $\phi = 3x^2y - y^3x^2$, Calculate grad ϕ at the point (1, -2, -1).

i) What is the difference between Compton effect and Photoelectric effect?

j) Radiation of wavelength 2400Å is incident on a metal surface whose photoelectric work function is 3.2eV. Calculate the maximum K.E. of the emitted photoelectrons and the stopping potential.

Part – II

Q2 Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) **(6 x 8)**

a) Derive the Lagrange's equation for a dimensional simple harmonics oscillator of mass 'm' and force constant 'k'.

b) Establish the differential equation of a damped harmonic oscillator subject to damping force proportional to velocity.

c) Find the intensity of the resultant wave, when two waves of same frequency moving in same direction superimpose on each other.

d) What are Fresnel's half period zones? Explain the factors on which the intensity at a point due to Fresnel's half period zones depend?

e) A two-dimensional lattice has the following basis vectors **a**=3**i**+2**j** and **b**=**i**+**j,** where **a, b** are basis vectors and **i** and **j** are unit vectors along x and y axes respectively. Find the reciprocal lattice.

f) Describe the working principle of He–Ne gas Laser with neat diagram.

g) State and explain Gauss divergence theorem. Explain its significance in electrostatics.

h) Write the integral form of the Ampere's circuital law. Write down the distinction between current and current density.

i) Show that $\vec{\nabla} A(r) = \hat{r}\frac{\partial A}{\partial r}$, where $\hat{r}$ is a unit vector along the position vector $\vec{r}$.

j) Evaluate the *expectation value of x* for a one-dimensional potential box of length L in the ground state, where one dimensional potential box $\psi_n(x) = \sqrt{\frac{2}{L}} Sin\frac{n\pi x}{L}$.

k) State Heisenberg's uncertainty principle. Show that an electron cannot be the constituent of an atomic nucleus.

l) Find the probability that a particle in a one-dimensional box length L can be found in between 0.40L and 0.60L for the ground state, where one dimensional potential box $\psi_n(x) = \sqrt{\frac{2}{L}} Sin\frac{n\pi x}{L}$.

Part – III

Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** The Lagrangian L is given by L=1/2 m $(dx/dt)^2$ +m $(dy/dt)^2$ -1/2k x^2-1/2 ky^2. Using it obtain Lagrange equation of motion and its solution(s). **(8)**

b) What is forced vibration? Obtain the steady-state solution for displacement when the damped harmonic oscillator is subjected to an external periodic force. **(8)**

Q4 **a)** Discuss the Fraunhofer diffraction due to a single slit. Find condition of Principal maximum and minimum. **(8)**

b) Describe the Michelson interferometer with a neat diagram and explain the formation of fringes in it. **(8)**

Q5 **a)** What is reciprocal lattice? Show that FCC lattice is reciprocal of BCC lattice. **(8)**

b) Describe the working principle of He–Ne gas Laser. What are the advantages of this Laser over Ruby Laser? **(8)**

Q6 **a)** Derive time independent and dependent Schrodinger equation and apply this for a free particle for finding its momentum and energy. **(12)**

b) The wave function for a quantum mechanical particle constrained to move in the region $-\pi/2 \le x \le \pi/2$ is given by Ψ=Asin2x. Normalize the wave function and obtain the normalization constant. **(4)**