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

Total Number of Pages : 02 B.Tech

RPH2A001

2nd Semester Regular Examination 2018-19

PHYSICS

BRANCH : AG, AUTO, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, ELECTRICAL, ENV, ETC, IT, MECH, MME, PE

Max Marks : 100

Time : 3 Hours

Q.CODE : F530

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

a) What is sharpness of resonance? What is the phase difference between the velocity and the driving force of a driven oscillator at resonance?
b) Define Q – factor of an oscillator. How does it depend on damping?
c) What difference between interference fringes and diffraction fringes?
d) How do the focal lengths of a zone plate depend on wavelength?
e) Explain the meaning of metastable state.
f) Mention the similarities and differences between unit cell and primitive cell.
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) Calculate the de-Broglie wave length associated with an electron at rest mass 9.1×10^{-31}kg accelerated on a potential of 100V.

Part- II

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

a) Distinguish between the progressive and stationary waves.
b) Setup the differential equation for a one-dimensional simple harmonic oscillator. Show that the total energy of the oscillator is constant in time.
c) Define coupled Oscillation. Formulate the differential equation for the coupled Oscillation and establish the normal mode equations.
d) Find an expression for the diameter of the nth ring in Newton's ring experiment?
e) Discuss the Fraunhofer diffraction due to a single slit. Find condition of Principal maximum and minimum.
f) Explain the difference between spontaneous emission and stimulated emission.
g) Show diagrammatically and differentiate the valence and conduction bands for insulators, conductors and semiconductors.
h) Prove that the curl of gradient of a scalar field is zero and divergence of curl of a vector field is zero.
i) Show that $\vec{\nabla} A(r) = \hat{r}\frac{\partial A}{\partial r}$, where $\hat{r}$ is an unit vector along the position vector $\vec{r}$.
j) State Heisenberg's uncertainty principle. Show that an electron cannot be the constituent of an atomic nucleus.

k) The normalised wave function of certain particle is $\psi(x)=\sqrt{\frac{3}{\pi}}Cosx$ where $-\frac{\pi}{2}<x<\frac{\pi}{2}$. Derive an expression for the expectation value of particle's momentum.

l) The wave function for certain particle is given as $\psi = Cos^2 x$ for $-\frac{\pi}{2}<x<\frac{\pi}{2}$. Obtain the normalised the wave function in the given range.

Part-III

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

Q3 A damped oscillator is subjected to a damping force proportional to its velocity. Setup the differential equation of the oscillator. Discuss the under-damped, over-damped and critically damped motion of the oscillator. **(16)**

Q4 Explain the working mechanism of a He – Ne laser. What is the meaning of resonance transfer in He – Ne laser? What are the advantages and limitations of a He – Ne laser? **(16)**

Q5 Write Maxwell's electromagnetic equations in integral and differential form. From Maxwell's electromagnetic equation in a medium, obtain the electromagnetic wave equations for electric field and magnetic field. **(16)**

Q6 A beam of monoenergetic particles is incident on a one-dimensional potential barrier. Show that the spacing between consecutive energy levels increases for higher energy values. How does the actual behavior of the particles differ from the predictions of classical physics? **(16)**