2021

PHYSICS-HONOURS-PRACTICAL

Paper: CC-11-P

Full Marks-30

Answer *any one* question.

[Write the code in pen and paper only. No computer output or plot is required.]

1. i) Solve stationary state one dimensional time independent Schrodinger equation

$$-\frac{\hbar^2}{2m}\frac{d^2\psi(x)}{dx^2}+V(x)\psi(x)=E\psi(x)$$

for a particle moving under the potential of a quantum harmonic oscillator $V(x)=\frac{1}{2}kx^2$. Necessary conversions can be made. Obtain the energy eigenvalues and plot the wavefunctions of ground state and first two excited states.

Program: 10, Algorithm: 3

ii) Solve the radial part of time independent Schrodinger equation

$$\left[-\frac{\hbar^2}{2m}\frac{d^2}{dr^2}+\frac{\hbar^2 l(l+1)}{2mr^2}+V(r)\right]U(r)=EU(r)$$

for a particle moving under the influence of Yukawa potential $V(r)=-V_0\frac{e^{-ar}}{r}$. Necessary conversions can be made. Obtain the energy eigenvalues and plot the wavefunctions of 1s, 2s and 2p orbitals.

Program: 14, Algorithm: 3

2. i) Solve stationary state one dimensional time independent Schrodinger equation

$$-\frac{\hbar^2}{2m}\frac{d^2\psi(x)}{dx^2}+V(x)\psi(x)=E\psi(x)$$

for a particle moving under the Morse potential $V(x)=D_e(1-e^{-\beta(x-x_e)})^2$. Necessary conversions can be made. Obtain the energy eigenvalues and plot the wavefunctions of ground state and first two excited states.

Program: 10, Algorithm: 3

ii) Solve the radial part of time independent Schrodinger equation

$$\left[-\frac{\hbar^2}{2m}\frac{d^2}{dr^2}+\frac{\hbar^2 l(l+1)}{2mr^2}+V(r)\right]U(r)=EU(r)$$

for the Hydrogen atom potential $V(r)=-\frac{e^2}{4\pi\epsilon_0 r}$. Obtain the energy eigenvalues and plot the wavefunctions of 1s, 2s and 2p orbitals.

Program: 14, Algorithm: 3

----End of question paper-----