

**GURUDAS COLLEGE Center**  
**PHYSICS Honours Semester-5**  
**CC-11 Practical Examination, 2020**

Answer **ANY TWO** of the following questions. [Marks: 30, Time: 1 hour]  
Each question has two parts. The programs for the two parts may be combined into a single program if it is convenient to do so.

1. (a) Write a computer program in *Python* for solving the following second order ordinary differential equation using the **Numerov method**:

$$\frac{d^2}{dx^2}y(x) + 2(1 - 2x^2)y(x) = 0$$

for given initial conditions  $y(0) = 1$  and  $[dy(x)/dx]_{x=0} = 0$  at  $n$  equally spaced values of  $x$  in the interval  $0 \leq x \leq 1$ . The value of  $n$  and the two initial conditions are to be read as inputs to the program. [10]

- (b) Write a computer program in *Python* using **matplotlib.pyplot** to plot the graph of the solution to the above differential equation. [5]
2. (a) Write a computer program in *Python* for solving the Schrödinger equation for the ground state of the infinite potential well using the **shooting method**: [10]
- (b) Write a computer program in *Python* using **matplotlib.pyplot** to plot the graph of the solution to the above differential equation. [5]

3. (a) Write a computer program in *Python* for solving the Schrödinger equation for the ground state of the quantum harmonic oscillator using the **shooting method**. **[10]**
- (b) Write a computer program in *Python* using **matplotlib.pyplot** to plot the graph of the solution to the above differential equation. **[5]**
  
4. (a) Write a computer program in *Python* for finding the eigenvalues of a particle in a finite potential well by solving the transcendental equation for the eigenvalue condition. **[10]**
- (b) Write a computer program in *Python* using **matplotlib.pyplot** to plot the graph of the eigenfunctions of the above system. **[5]**