B.Sc. Even Semester Examination, 2021

Sem-4 Sub : PHSA Paper : CC10-P FM : 30

1. Consider the second order linear ODE

$$\ddot{y}(t)+r(t)\,\dot{y}(t)+q(t)\,y(t)=s(t)$$

where dot and double dot mean differential coefficients with respect to t . Explain, with analytical calculation, how is it possible to construct a function that solves the equation. Write down the function as a Python function. 3+3

2. Write a Python function to compute the roots of the following equations

$$x\cot(x) = -y,\ x^2 + y^2 = b\,,\ b = \text{constant}$$

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3. What is meant by "Bound state problem" of a finite potential well ? Write an algorithm to solve the bound state problem of the finite potential well with range 1 unit, Potential 1 unit and strength parameter 5. 1+5

4. What are Boundary value problem and Initial value problem ? How is it possible to transform the boundary value problem

$$\frac{d^2u(t)}{dt}=g(t,u) \quad \text{with } a<t<b \text{ and } u(a)=\beta,\ u(b)=\eta$$

to an initial value problem ? 2+4

5. Write a Python program to plot the third excited state of a quantized linear harmonic oscillator given its eigenvalues $E_n = (n+1/2)h\nu$. Symbols have usual meaning. 6