



Continuous Assessment Test (CAT - II), December 2022

| | | | |
|--------------|--------------------------------------------------|-------------|------------------|
| Programme | : B.Tech | Semester | : Fall 2022-2023 |
| Course Title | : Engineering Physics | Course Code | : BPHY101L |
| School | : School of Advanced Sciences | Slot | : E2+TE2 |
| Duration | : 90 mins | Max. Marks | : 50 |
| Class No | : 5877, 5819, 5862, 5872, 5804, 5881, 5776, 5753 | | |

Part - A (5 x 10 = 50)

Answer ALL Questions

| Sl. No | Questions | Max Marks |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1 | Discuss in detail the experiment that gave the experimental proof of the wave nature of matter with suitable diagrams. | 10 |
| 2 | Write three conditions for acceptable wave functions and explain the significance of probability density. From the time-dependent Schrodinger wave equation, deduce the time-independent wave equation for matter waves. (3+2+5 marks) | 10 |
| 3 | (a) What is an ultraviolet catastrophe? Write down the Planks formula for black body radiation and show under what conditions it reduces to Rayleigh-Jeans law. (2+1+2 marks) (b) An electron has a speed of 400 m/s with an accuracy of 0.007 %. Calculate the certainty with which we can locate the position of the electron. | 5 5 |
| 4 | Write the energy eigenvalues for the first three states of the particle trapped in the 1-D box of dimension L and plot the corresponding wavefunction and probability density states for those states. Explain why the particles are never at rest inside the 1-D box. (3+2+2+3 marks) | 10 |
| 5 | (a) Explain how quantum confinement leads to various nanomaterials citing one example of each. (b) A 1-eV electron got trapped inside the surface of a metal. If the potential barrier is 4.0 eV and the width of the barrier is 2 Å. Calculate the probability of its transmission. | 5 5 |

