

Roll No. ....

**Y – 3119 (A)**  
**M.Sc. (Second Semester) (SPECIAL) EXAMINATION,**  
**August 2021**  
**(SECOND CHANCE)**  
**PHYSICS**  
Paper – 202

**NONRELATIVISTIC QUANTUM MECHANICS-1**

*Time : Three Hours*

*Maximum Marks : 85*

*Minimum Pass Marks : 29*

**Note**—Attempt *all* questions.

1. What is angular momentum. Find out the eigen values and eigen functions of  $L^2$  and  $L_z$ . 17
2. Apply the Schrodinger's wave equation solve the problem of particle in a 3D-box with potential defined as;  
$$V = \begin{cases} 0 & \text{inside box} \\ \infty & \text{otherwise} \end{cases}$$
 Find out the energy and wave function of the particle.  
What will happen to the wave function and energy if degrees of freedom of the particle are reduced to two ? 17
3. What are the raising and lowering operators ? Explain the matrix theory of linear harmonic oscillator. 17
4. What are WKB approximations and apply them to find out the bound energy levels in a potential well. 17
5. What is stark effect ? Explain the stark effect on ground state of hydrogen atom with the help of perturbation theory. 17