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**GIET UNIVERSITY, GUNUPUR – 765022**  
M. Sc. (Second Semester) Examinations, September – 2021  
**20PHPC204 – QUANTUM MECHANICS-II**  
(Physics)

Time: 2 hrs

Maximum: 50 Marks

(The figures in the right hand margin indicate marks.)

**PART – A**

- Q.1. Answer **ALL** questions **(2 x 10 = 20 Marks)**
- Write three dimensional Schrödinger equation in spherically polar coordinates?
  - Express the radial equation for a particle moving in a spherically symmetric field?
  - Estimate the normalized radial wave function for Hydrogen atom for  $n=1$ ?
  - What are different types of approximate methods used in QM?
  - A particle of charge 'q' and mass 'm' is moving with a one dimensional harmonic potential of frequency 'w' is subjected to a weak electric field 'E' in the x-direction. Find the first order correction of energy?
  - Explain Bohr-Sommerfeld quantisation rule?
  - Differentiate between Linear Stark effect and Quadratic Stark effect?
  - Discuss about the few assumptions made in the scattering theory?
  - Define scattering amplitude, scattering cross section and total scattering cross section?
  - What do you mean by symmetric and anti-symmetric wave function?

**PART – B (6 x 5 = 30 Marks)**

- | <u>Answer ANY FIVE questions</u>   | Marks |
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| 2. Solve the radial part of the Schrodinger's wave equation for Hydrogen atom to obtain the energy Eigen values?             | (6)   |
| 3. Give the theory of time independent perturbation for degenerate systems and explain the normal Zeeman effect?             | (6)   |
| 4. Explain variational method and evaluate the energy level of normal state of Helium atom using variational method?         | (6)   |
| 5. Apply Born approximation theory, to derive the differential cross section for scattering by a screened Coulomb potential? | (6)   |
| 6. State and prove the Optical theorem?  | (6)   |
| 7. Derive the total scattering cross section by a Hard sphere? Discuss its low energy limit case?                            | (6)   |
| 8.. Discuss about the symmetric and anti-symmetric wave function?  | (6)   |

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