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GIET UNIVERSITY, GUNUPUR – 765022
M. Sc (Second Semester) Examinations, July – 2023
22PHPC204 – QUANTUM MECHANICS-II
(Physics)

Time: 3 hrs

Maximum: 70 Marks

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

PART – A**(2 x 10 = 20 Marks)**Q.1. Answer *ALL* questions

	CO #	Blooms Level
a. Define effective Potential and discuss its characteristics?	CO1	K1
b. Deduce the expression for the radial probability density?	CO1	K2
c. Differentiate between degeneracy and non-degeneracy with suitable examples?	CO1	K1
d. Discuss the different types of approximate methods?	CO2	K1
e. Show that there is no first order Stark effect for ground state of Hydrogen atom?	CO2	K2
f. Discuss about the ‘Fermi golden rule’?	CO3	K1
g. Discuss about Bohr-Sommerfield quantisation rule?	CO3	K1
h. Explain the ‘Connection formulae’?	CO3	K1
i. What do you mean by quantum theory of Scattering? Give examples?	CO4	K1
j. Differentiate between screened Coulomb potential and Coulomb potential?	CO4	K1

PART – B**(10 x 5=50 Marks)**Answer ANY FIVE questions

	Marks	CO #	Blooms Level
2.a. Derive the solution to Schrödinger’s equation for a free particle in spherical polar co-ordinate system?	05	CO1	K1
b. Derive the Expression of plane waves in terms of spherical waves?	05	CO1	K1
3. Solve the radial part of the Schrodinger’s wave equation for hydrogen atom to obtain the energy eigen values? Under which condition the degeneracy will be removed?	10	CO1	K1
4. Define normal Zeeman effect? Explain the unperturbed, 1 st order perturbed and 2 nd order perturbed part of Hamiltonian? Derive the 1 st order energy of Zeeman effect in Hydrogen atom? Generate all the degenerate states for n=1, n=2 and n=3 with eigen values?	10	CO2	K2
5. Discuss about the Time –dependent perturbation theory? Establish the necessary theory of zeroth order & first order perturbation? Explain its	10	CO3	K2

physical significance?

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| 6. Explain variational method and evaluate the energy level of ground state of Helium atom using variational method? Compare the result with experimental value? | 10 | CO3 | K2 |
| 7.. What is Born Approximation? Derive the expression for the total scattering cross section when scattering occurs by a perfectly hard sphere potential for low and high energy limit? Compare the result with classical result? | 10 | CO4 | K2 |
| 8. What is Partial Wave Analysis for scattering problem? Derive the expression for a plane wave as a sum of spherical waves? Derive the expression for the scattering amplitude and total scattering cross section in terms phase shift using partial wave analysis? | 10 | CO4 | K2 |

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