QP Code:R262G019 | Reg. No | | | | | | | | | | | AY 25

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)

M.Sc. (Second Semester – Regular/Supplementary) Examinations, May – 2026

24MPHPC12004 – Quantum Mechanics-II

(Physics)

Time: 3 hrs | Maximum: 60 Marks

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	What is free particle problem?	CO1	K1
b.	Discuss about the various approximation methods used to solve quantum problems.	CO2	K1
c.	Explain Fermi Golden Rule.	CO3	K1
d.	Explain Bohr-Summerfield quantisation Rule.	CO4	K1
e.	Explain Born Approximation and its validity.	CO5	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	Derive the Radial part of the Schrodinger's wave equation in Spherical symmetric field.	10	CO1	K1
	(OR)			
b.	Reduce the two body problem to equivalent one body problem to obtain Effective mass.	05	CO1	K2
c.	Write the Radial equation for Hydrogen atom in spherically polar coordinate and find the Energy eigen value of H_2 atom.	05	CO1	K2
3.a.	Derive 1st order and 2nd order perturbation equation for time independent non-degenerate case and evaluate the 1st order perturbation of Energy.	10	CO2	K1
	(OR)			
b.	Explain the Perturbation theory for an an-harmonic oscillator up to 2nd order, where the interaction energy is equal to $\frac{1}{2}bx$.	10	CO2	K2
4.a.	What is normal Zeeman effect? Derive the Hamiltonian for the 1st order perturbation and derive the 1st order energy eigen value for H_2 atom.	10	CO3	K2
	(OR)			
b.	Discuss with necessary theory of Variational principle to determine the ground state energy from the upper bound values of eigen value whose Hamiltonian is known.	05	CO3	K2
c.	Briefly discuss concept of the cold emission and derive the expression of Transition Probability.	05	CO3	K2
5.a.	Explain 1st Born Approximation and derive the Scattering cross-section.	05	CO4	K2
b.	State and Prove the Optical theorem.	05	CO4	K1
	(OR)			
c.	Show that a Plane wave is equivalent to superposition of a number of Spherical waves using Plane Wave Analysis.	10	CO4	K1

6.a.	Apply Born approximation to derive the differential cross section for scattering by a screened Coulomb potential.	10	CO5	K2
	(OR)			
b.	Derive the expression of Scattering cross section from a square well potential.	05	CO5	K2
c.	Explain about the Scattering of identical particles.	05	CO5	K1

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