BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC/MSC/PRE-PHD **SEMESTER :IX/III**
BRANCH: PHYSICS **SESSION : MO/2023**

SUBJECT: PH502 ADVANCED QUANTUM MECHANICS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Applying non-degenerate perturbation theory Derive unperturbed, first order perturbation and second order perturbation equations.	[5]	CO1	III
Q.1(b)	Evaluate the first order energy.	[5]	CO1	V
Q.2(a)	Explain with a diagram spin-orbit interaction.	[5]	CO1	II
Q.2(b)	Discuss the importance of Born-Oppenheimer approximation?	[5]	CO2	VI
Q.3(a)	Write down the time dependent wave function $\Psi(t)$ of a two level system containing the coefficients c_a and c_b. Discuss the time dependent perturbation method to obtain the derivative of c_a and c_b.	[5]	CO4	VI
Q.3(b)	When the perturbation is small, Find c_a and c_b in the first and second order approximation.	[5]	CO4	I
Q.4(a)	Develop an expression for vector potential of pure radiation field using method of separation of variables.	[5]	CO3	III
Q.4(b)	Find also the Hamiltonian of the radiation field due to electric field only.	[5]	CO3	I
Q.5(a)	Starting from the Dirac Hamiltonian, construct Dirac relativistic equation for a free particle.	[5]	CO5	VI
Q.5(b)	Determine suitable form of Dirac matrices.	[5]	CO5	V

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