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

CLASS: IMSc / MSc   **SEMESTER : VII/I**
BRANCH: PHYSICS   **SESSION : MO/2024**

SUBJECT: PH404 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)	Prove that eigenvalues of an Hermitian matrix H are real and eigenfuntions correspoding to different eigenvalues of H are orthogonal.	[10]	1	1,2
Q.2(a)	Write down the postulates of quantum mechanics and provide an algorithm to find the propagator for any quantum system.	[10]	2	1,2
Q.3(a)	Find the average momentum of the electron in a Hydrogen atom in the ground state given by $\psi_{100} = \dfrac{1}{\sqrt{\pi a_0^3}} \exp(-r/a_0)$.	[10]	3	2,3
Q.4(a)	Find the eigenvalues and normalised eigenfunctions of S_x , S_y and S_z operators.	[10]	4	1,2
Q.5(a)	Find the matrix elements of $S_1 \cdot S_2$ in the product basis of two spin-half particles.	[10]	5	2,3

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