

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

CLASS: I MSc
BRANCH: PHYSICS

SEMESTER : IV
SESSION : SP/2023

SUBJECT: PH208 ELEMENTS OF MODERN PHYSICS

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) Develop Einstein's photoelectric equation. How is Einstein's hypothesis in relation to energy quanta of an electromagnetic radiation is an extension to that of Planck's?	[5]	1	VI
Q.1(b) Define Heisenberg's uncertainty principle. Using uncertainty relation, prove that an electron cannot exist within a nucleus.	[5]	1	I
Q.2(a) What are matter waves? What are the characteristics of a wavefunction representing matter waves? The wavefunction of a moving particle is given by $\psi(x) = Ae^{-\alpha x^2}$ Where $-\infty < x < \infty$, and A and α are constants. Find the value of A and the probability of finding the particle in the region $0 < x < \infty$.	[5]	2	I
Q.2(b) Using plane wave equations, develop the time independent and time dependent form of Schrödinger equation.	[5]	2	III
Q.3(a) A particle is confined in a one-dimensional infinite square well defined as: $V(x) = 0, \text{ for } -a < x < a$ $= \infty, \text{ for } x \geq a$ where a is a positive constant. Evaluate the energy eigen values of the system.	[5]	3	V
Q.3(b) Define tunneling. Calculate the percentage transmission of an electron beam of energy 3 eV which incident on a potential barrier of height 4 eV and width 20 Å.	[5]	3	I
Q.4(a) Develop semi empirical mass formula based on liquid drop model.	[5]	4	VI
Q.4(b) Explain shell model. What are magic numbers?	[5]	4	V
Q.5(a) Develop the relation between Einstein A & B coefficient.	[5]	5	III
Q.5(b) Explain how population inversion is achieved in Ruby laser.	[5]	5	V

:::25/04/2023:::M