



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

M.Sc. (Fourth Semester – Regular/ Supplementary) Examinations, April – 2026

24MPHPE24011 - Atomic & Molecular Physics

(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 meant by selection rules?	CO1	K1
b. Discuss few fundamentals properties of Laser.	CO2	K1
c. Define Lande g-factor & write its expression.	CO3	K2
d. What is population inversion?	CO4	K1
e. Define Lamb shift and isotope shift.	CO5	K1

PART – B

(10 x 5 = 50 Marks)

Answer **ALL** the questions

	Marks	CO #	Blooms Level
2. a. Explain the Bohr model and calculate energy & radius for H-atom orbits.	10	CO1	K2
(OR)			
b. Discuss the experimental observations and theoretical development in discovery of constituents of an atom using Thomson model.	10	CO1	K1
3.a. Discuss Sommerfeld Extension of Bohr Theory.	7	CO2	K2
b. Write the shortcomings of Bohr Atomic model.	3	CO2	K1
(OR)			
c. Explain LS coupling (Russell–Saunders coupling) in atomic physics.	3	CO2	K2
d. Discuss their physical basis, quantum numbers involved, and energy level formation of LS coupling.	7	CO2	K1
4.a. Discuss in detail about the quantum theory of normal Zeeman effect and energy level splitting in presence of magnetic fields.	10	CO3	K2
(OR)			
b. Explain the principle of Mössbauer spectroscopy. Discuss the Mössbauer effect and describe the experimental setup.	7	CO3	K2
c. Explain Born-Oppenheimer approximation.	3	CO3	K1
5.a. What type of particles were used in Rutherford scattering? What is meant by impact parameter?	3	CO4	K1
b. Discuss construction, working principle, energy level diagram and applications of He-Ne Laser.	7	CO4	K2
(OR)			
c. Explain the working principle of a semiconductor laser. Describe its construction, energy band diagram, and working mechanism.	7	CO4	K2
d. Explain the concept of a laser resonator.	3	CO4	K1
6.a. Discuss in detail about the Instrumentation and sample handling in Infrared Spectroscopy.	8	CO5	K2
b. What is the fingerprint region in Infrared Spectroscopy?	2	CO5	K1
(OR)			
c. Explain the Franck–Condon principle with the help of a potential energy diagram.	8	CO5	K2
d. Explain the significance of Franck–Condon principle in spectroscopy.	2	CO5	K1

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