PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2025
(Third Semester)

Branch – PHYSICS

ATOMIC, MOLECULAR AND LASER PHYSICS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)
Answer ALL questions

ALL questions carry EQUAL marks   (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	How does the Zeeman effect provide evidence for the Bohr model? a) Splitting of spectral lines in a magnetic field. b) Emission of continuous spectra. c) It reveals the absorption of X-rays. d) Quantization of orbital angular momentum.	K1	CO1
	2	Compare the Bohr model with Rutherford's model of the atom. a) Both models propose electrons orbit the nucleus in fixed paths. b) Bohr's model introduces quantized energy levels while Rutherford's model does not. c) Rutherford's model includes quantized orbits, whereas Bohr's does not. d) Both models use the concept of electron clouds.	K2	CO1
2	3	Identify the quantum number associated with the orientation of an orbital. a) Principal quantum number (n) b) Orbital angular momentum quantum number (l) c) Magnetic quantum number (m_l) d) Spin quantum number (s)	K1	CO2
	4	Explain the role of quantum numbers in the vector atom model. a) Specifies the size, shape, and orientation of orbitals. b) Determines the color of emitted light. c) Used to measure atomic mass. d) Describes the charge of electrons.	K2	CO2
3	5	Define Compton scattering. a) The scattering of X-rays by crystals b) The change in wavelength of X-rays when scattered by electrons c) The absorption of X-rays by a material d) The emission of X-rays from a material	K1	CO3
	6	Relate the concept of Bragg's law to X-ray diffraction. a) Diffraction angles to the interatomic spacing in crystals. b) Determines the energy of X-rays c) Calculates the intensity of X-ray spectra. d) Measures the wavelength of X-rays.	K2	CO3
4	7	List the types of electromagnetic radiation used in spectroscopy. a) UV, visible, IR, and X-rays b) Gamma rays, microwaves, and radio waves c) UV, infrared, and microwaves d) Visible, UV, and X-ray	K1	CO4
	8	Relate the interaction of electromagnetic radiation with matter to Beer's Law. a) Absorption of light by a solution depends on the concentration and path length. b) Scattering of light in a sample. c) Measures the emission spectrum of a sample. d) Determines the diffraction pattern of light.	K2	CO4

Module No.		Question No.	Question	K Level	CO
5	9		Name the type of laser used in laser-induced fusion. a) He-Ne laser　　　　b) Ruby laser c) Semiconductor laser　　d) Nd laser	K1	CO5
	10		Illustrate the application of lasers in medicine. a) Precise surgical procedures and tissue removal. b) Chemical synthesis in medicine. c) X-ray imaging in medical diagnostics. d) Temperature measurement in medical devices.	K2	CO5

SECTION - B (35 Marks)
Answer ALL questions
ALL questions carry EQUAL Marks　　　(5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Explain the key postulates of the Bohr atom model.	K2	CO1
		(OR)		
	11.b.	Demonstrate how the Frank and Hertz experiment supports the Bohr model.		
2	12.a.	Apply the vector atom model to describe the possible values of the magnetic quantum number (m_l) for a given orbital angular momentum quantum number (l).	K3	CO2
		(OR)		
	12.b.	Identify the significance of the work function in the photoelectric effect.		
3	13.a.	Construct an explanation of how the Compton effect demonstrates the particle nature of X-rays.	K3	CO3
		(OR)		
	13.b.	Utilize the Laue method to analyze the crystal structure using X-ray diffraction.		
4	14.a.	Compare UV-Vis spectroscopy with IR spectroscopy in terms of their applications.	K4	CO4
		(OR)		
	14.b.	Contrast optical absorption spectroscopy with Raman spectroscopy.		
5	15.a.	Examine the role of pumping in laser operation and its impact on laser efficiency.	K4	CO5
		(OR)		
	15.b.	Distinguish between continuous wave (CW) lasers and pulsed lasers in terms of their operation and applications.		

SECTION -C (30 Marks)
Answer ANY THREE questions
ALL questions carry EQUAL Marks　　(3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Analyze the limitations of the Bohr atom model in explaining multi-electron atoms.	K4	CO1
2	17	Distinguish between photoelectric cells and photovoltaic cells in terms of their applications and operating principles.	K4	CO2
3	18	Examine how the Compton scattering experiment supports the particle theory of light.	K4	CO3
4	19	Examine the role of instrumentation in enhancing the resolution and sensitivity of spectroscopic measurements.	K4	CO4
5	20	Analyze the impact of the gain medium on the performance of a laser.	K4	CO5