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B-2167

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FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. Pattern - 2013 (T.Y SEM VI)

Examination November / December 2025

Physics Paper-XIX (Atomic, Molecular Physics & Laser)

[Time: 1:30 Hours]

[Max. Marks: 50]

Please check whether you have got the right question paper.

N. B

- 1) Solve all questions.
- 2) Draw neat diagrams wherever necessary.

Q1

1. Discuss Bohr's theory of origin of spectral lines. 10
 2. With a suitable diagram, explain the experimental study of the Raman Effect. 10
- OR**
3. What is selection rule? Explain L-S coupling and J-J coupling. 10
 4. Describe the construction and working of ruby laser with suitable diagram. 10

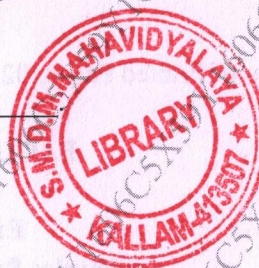
Q2

1. State the limitations of Thomson's atom model. 05
 2. Find the reduced mass of an HCl molecule. 05
- [The mass of ^{35}Cl is 5.81×10^{-26} and that of H is 1.67×10^{-27} kg]
3. Explain the total OR principal quantum number. 05
 4. What is the electron energy must be transferred to an atom of sodium vapour in order to stimulate the emission of sodium D-lines? Given $\lambda_{\text{mean}} = 5893 \text{ \AA}$ 05
- OR**
1. Find the longest wavelength in the Paschen series. ($R = 1.097 \times 10^7 \text{ m}^{-1}$) 05
 2. What are the applications of the Raman Effect? 05
 3. Find the angular momentum of a d-electron, $h = 6.63 \times 10^{-34} \text{ Js}$ 05
 4. Write a note on Laser pumping. 05

Q3 Choose the correct answer.

10

1. The splitting of the spectral lines under the influence of a magnetic field is called _____.
 - a) Zeeman effect
 - b) Crompton effect
 - c) Photoelectric effect
 - d) Stark effect
2. If 'r' is the radius of the first Bohr's orbit, then the radius of the 3rd Bohr's orbit is _____.
 - a) r
 - b) 3r
 - c) 6r
 - d) $\sqrt{3}$
3. Energy of an electron in the ground state is _____.
 - a) -13.6 eV
 - b) 13.6 J
 - c) 13.6 eV
 - d) 1.36 eV



4. By convention, an electron for which, $l = 2$ then it is, _____.
a) s-electron b) p-electron
c) d-electron d) f-electron
5. All the three vectors L , S , and J are _____.
a) Parallel b) Anti-parallel c) Perpendicular d) Quantized
6. The ratio of the energy of rotational levels for $J=1$ to $J=2$ is _____.
a) 1:3 b) 1:2 c) 3:1 d) 2:1
7. The energy of a diatomic molecule in the ground state is _____.
a) Infinite b) Zero c) Positive d) Negative
8. Stokes and anti-Stokes lines are observed in, _____.
a) X-ray spectra b) Hydrogen spectra
c) Molecular spectra d) Raman spectra
9. He-Ne laser is _____.
a) Four-level laser system b) Three-level laser system
c) Two-level laser system d) Without any level laser
10. The energy of one photon of wavelength 6000 Å is _____.
a) $1.66 \times 10^{-19} \text{ J}$ b) $2.63 \times 10^{-19} \text{ J}$ c) $1.61 \times 10^{-19} \text{ J}$ d) $4.65 \times 10^{-19} \text{ J}$