



23144688

QP CODE: 23144688

Reg No :

Name :

M Sc DEGREE (CSS) EXAMINATION, NOVEMBER 2023**Third Semester**

Faculty of Science

M Sc PHYSICS

CORE - PH010303 - ATOMIC AND MOLECULAR PHYSICS

2019 ADMISSION ONWARDS

2EA68629

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)*Answer any **eight** questions.**Weight 1 each.*

1. What are the possible values of n , l and m_s if a hydrogen atom has $m_l = -2$?
2. $^3D_{5/2}$ is not a possible spectral term. Justify the statement.
3. What is a selection rule? Give the selection rule for a rigid diatomic rotator.
4. Explain the nature of Morse function of a vibrating molecule.
5. Explain the structure determination of SO_2 molecule using Raman and IR?
6. What are the features of Stimulated Raman Scattering and give its application?
7. Explain progression in vibrational coarse structure.
8. Explain spin -spin relaxation process .
9. How do you calculate chemical shift?
10. What are the basic requirements of X-band spectrometer?

(8×1=8 weightage)

Part B (Short Essay/Problems)*Answer any **six** questions.**Weight 2 each.*

11. Draw the anomalous Zeeman pattern for the D1 and D2 lines of sodium.
12. Illustrate with energy level diagram Paschen-Back effect for the D1 line of sodium





13. What are the factors affecting intensity of spectral lines? Predict the J value of the rotational level with maximum population
14. Explain the breakdown of Born-Oppenheimer approximation of diatomic vibrating rotator.
15. A substance shows Raman line at 4570 \AA^0 when the exciting line is 4358 \AA^0 . Find the positions of Stokes and anti-Stokes lines for the same substance if the wavelength of the exciting line is 4047 \AA^0 .
16. Explain the frequency components of Raman scattering.
17. Mathematically support the hyperfine structure in ESR.
18. A Mossbauer nucleus ^{57}Fe makes the transition from the excited state of energy 14.4 keV to the ground state. What is the recoil energy and velocity?

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight **5** each.

19. Derive the spin orbit interaction energy in hydrogen like atom extended to penetrating orbits. Also discuss about the fine structure in sodium atom.
20. Write notes on (i) Molecular Structure (ii) Dipole Moment (iii) Atomic mass (iv) Nuclear quadrupole moment derivable from rotational spectra.
21. Discuss on rotational fine structure of electronic-vibrational transition
22. Explain in detail (i) quadrupole interaction (ii) magnetic hyperfine interaction and (iii) isomer shift in Mossbauer spectroscopy.

(2×5=10 weightage)

