S.Y. M.Sc. (Physics) (CBCS Pattern) Fourth Semester CBCS

PSCPHYT15.3 - Core Elective E-2.4 - Atomic and Molecular Physics-II

Paper-15

P. Pages : 2 **GUG/W/18/11417**

Time : Three Hours * 3 5 0 9 * Max. Marks : 80

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1. Either

a) Explain the concept of time dependent perturbation theory. Derive an expression for time dependent perturbation coefficient (Cn). **8**

b) Consider an electric field $E_0 \cos \omega t$ is affecting on an atom. Estimate an expression for Einstein coefficient (B) for an emission rate of stimulated emission. **8**

OR

e) State and prove fluctuation dissipation theorem rotational correlation function. **8**

f) Obtain an expression for rotational energy levels of diatomic molecule and frequency of rotational spectra so that in rotational spectra the lines are equidistance on frequency scale. **8**

2. Either

a) State and Explain the concept of saturated absorption spectroscopy. Show that the ratio of the peak cross-section is nearly equal to the ratio of line width. **8**

b) Describe two photon spectroscopy of 1S-2S transition in atomic hydrogen atom. Discuss calibration in laser spectroscopy using. **8**

a) Calibration of relative frequency.

b) Absolute calibration.

OR

e) What is photo acoustic spectroscopy? Derive an expression for two photon absorption cross-section for photo-acoustic spectroscopy in gaseous medium. **8**

f) Describe the Rosenzweig and greshow theory in details. **8**

3. Either

a) What are the different types of emission? Explain using Jablonski diagram. Derive an expression for quantum yield. **8**

b) Write a note on- **8**
i) Light detectors.
ii) Single photon counting technique.

OR

e) What is stimulated Raman scattering? Draw the energy level diagram for stimulated Raman scattering. **8**

f) Describe electromagnetic theory for stimulated Raman spectroscopy. Describe the selection rule. **8**

4. Either

a) What are the different kind of symmetry operation? Explain these operation for C_{2V} and C_{3V} point groups. **8**

b) What is matrix isolation? Explain in detail. What are the limitations of matrix representation? **8**

OR

e) Explain group theory in detail. Give the application of group theory to molecular vibrations. **8**

f) Give matrix representation of symmetry elements of a point group. Explain. **8**
i) Reducible
ii) Irreducible representations.

5. All questions are compulsory.

a) Explain Re-orientational spectroscopy of liquids. **4**

b) Describe experimental methods of saturation spectroscopy in laser. **4**

c) Determine the expression for life time of excited state for time resolved fluorescence. **4**

d) Explain Laser cooling? Give its applications? **4**

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