

M.Sc. S.Y. (Physics) (CBCS Pattern) Semester - III  
**PSCPHYT11-3 - Core Elective E1.3 : Atomic and Molecular Physics-I**

P. Pages : 2

Time : Three Hours



**GUG/S/23/11300**

Max. Marks : 80

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**Either:**

1. a) What are quantum states of an electron in an atom? Explain in detail the spectrum of hydrogen atom. **8**
- b) Explain the concepts of NMR spectroscopy. **4**
- c) Explain spin lattice relaxation. **4**

**OR**

- e) Explain the concept of Mossbauer effect in  $\gamma$ -rays. **8**
- f) Explain chemical shift in Mossbauer spectroscopy. **4**
- g) Explain magnetic hyper fine interaction. **4**

**Either:**

2. a) Explain the principle of ESR. Describe an experimental set-up. **10**
- b) Discuss the general theory of hyperfine splitting. **6**

**OR**

- e) Explain Paschen back effect. **4**
- f) Explain construction and working of He-Ne laser. **6**
- g) Derive the relation between Einstein coefficients A and B. **6**

**Either:**

3. a) Explain rotational and vibrational energy of diatomic molecules. **6**
- b) Discuss molecular polarizability. **4**
- c) Explain Intensity alteration in Raman spectra of diatomic molecules. **6**

**OR**

- e) What is Raman effect? Give the characteristics and experimental set-up. Explain quantum Raman effect. **8**

- f) Explain Hund's rule. 4
- g) Explain polyatomic molecules by using Raman spectroscopy. 4

**Either:**

4. a) Discuss Born-Oppenheimer approximation. 8
- b) Discuss vibrational coarse structure of electronic bands. 4
- c) Explain Franck Condon principle. 4

**OR**

- e) Explain electronic spectra of diatomic molecules. 4
- f) Explain dissociation and pre dissociation energies. 4
- g) Explain the general treatment of molecular orbitals. 4

5. Answer **all** the followings.

- a) Explain spin-spin interaction in NMR. 4
- b) Explain Ammonia MASER. 4
- c) Explain spectra of symmetric top and asymmetric top molecules. 4
- d) Explain and give the examples Hund's coupling cases. 4

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