

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

P. Pages : 2

Time : Three Hours



**GUG/W/24/11300**

Max. Marks : 80

---

**Either:**

1. a) Explain the principle of NMR? How is NMR frequency related to external magnetic field applied. 8

b) Explain the Mossbauer effect of gamma rays. Describe it's experimental techniques. 8

**OR**

e) Explain Quantum states of an electron in an atomic electron spin. 8

f) Discuss the terms spin-spin and spin-lattice relaxation. 8

**Either:**

2. a) What is ESR? Explain the experimental setup to study ESR? 8

b) Discuss Paschen Back and stark effect in details. 8

**OR**

e) Explain the normal and anomalous Zeeman effect. 8

f) Discuss spontaneous and stimulated emission. 4

g) Explain the terms LS and JJ coupling. 4

**Either:**

3. a) Explain rotational and vibrational energy of diatomic molecules. 8

b) Explain Raman effect. Describe the experimental set up to study it. Outline the theory of Raman effect. 8

**OR**

e) Explain molecular polarizability with the help of examples. 8

f) Discuss Hund's rule. 8

**Either:**

- |           |    |  |          |
|-----------|----|--|----------|
| <b>4.</b> | a) | Explain Born Oppenheimer approximation.    | <b>8</b> |
|           | b) | Explain Franck Condon principle.           | <b>4</b> |
|           | c) | Explain dissociation and pre-dissociation. | <b>4</b> |

**OR**

- |           |    |   |          |
|-----------|----|---|----------|
|           | e) | Explain electronic spectra of diatomic molecules.                           | <b>8</b> |
|           | f) | Explain in details Rotational fine structure of electronic bands in detail. | <b>8</b> |
| <b>5.</b> |    | Attempt all the followings.   |          |
|           | a) | Explain chemical shift.   | <b>4</b> |
|           | b) | Explain in detail Ruby Laser.   | <b>4</b> |
|           | c) | Explain spectra of symmetric top and asymmetric top molecules.              | <b>4</b> |
|           | d) | Explain Hund's coupling cases.  | <b>4</b> |

\*\*\*\*\*