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MSC2PhyC202x

Seat No : _____

M.Sc. (Physics) Semester - 2 (CBCS) Examination
August/September -2020 [NEW COURSE]
Atomic and Molecular Physics (CORE)

Time: 2:00 Hours

Marks: 56

Instructions:

1. Figure to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any four of the following questions.

Q - 1: Answer any Seven:

14

- (a) In case of four electrons, what should be the possible values of spin angular momenta? Give the reason of your answer.
- (b) Is transition $^2P_{3/2} \rightarrow ^2D_{3/2}$ is allowed? Give the reason of your answer on the basis of selection rule.
- (c) What do you mean by L-S coupling? When this coupling takes place?
- (d) Draw the diagram of precession of Spin vector S, Orbital vector L and Total vector J around external magnetic field direction when the field is weak and strong.
- (e) What are rigid and non-rigid rotators?
- (f) Transition originating from the level having which J value will have the maximum intensity?
- (g) What quantum numbers J and K represents?
- (h) What are near prolate and near oblate asymmetric rotors?
- (i) What are the hot bands?
- (j) Depict the normal vibrations of CO₂ molecule.

Q - 2: Write any Two:

14

- (a) What are building up rules? On their basis, explain how electrons occupy orbitals in large atoms. *unit-1*
- (b) Discuss orbital angular momentum, spin angular momentum and total angular momentum of the electron. *unit-1*
- (c) Discuss the fine structure of Hydrogen atom spectrum. *unit-1*

Q - 3: Answer the following questions: ALL ARE COMPULSORY

- (a) Discuss the two concepts of vector atom model. *unit-2* 07
- (b) Discuss the magnetic moment of electron due to its orbital and spin motion. *unit-2* 07

OR

Q - 3: Answer the following questions: ALL ARE COMPULSORY

- (a) How molecules are classified based on the relative values of Principal moments of inertia? Explain with examples. *unit-3* 07
- (b) Discuss non-rigid rotator in detail. Also compare the energy levels and spectrum of rigid and non-rigid rotators. *unit-3* 07

Q - 4: Write any Two:

14

- (a) Discuss the first order Stark effect of a symmetric top molecule for the $J = 1, K = 1 \rightarrow J = 2, K = 1$ transition. *unit-4* 14
- (b) Discuss the Morse curve and the energy levels of a diatomic molecule. *unit-4*
- (c) Explain asymmetric top molecules in detail showing the energy level correlation diagram for asymmetric rotor. *unit-4*

Q - 5: Write notes on any Two:

14

- (a) Selection rules. *unit-2*
- (b) Symmetric stretching, bending and asymmetric stretching in H₂O molecule.
- (c) IR spectrophotometer. *unit-5*
- (d) Diatomic vibrating rotator. *unit-5*
