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C.U.SHAH UNIVERSITY Summer Examination-2019

Subject Name: Atomic and Molecular Physics

Subject Code: 5S	C02AMP1	Branch: M.Sc. (Physics)	
Semester: 2	Date: 20/04/2019	Time: 02:30 To 05:30	Marks: 70

Instructions:

- (1) Use of Programmable calculator and any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

SECTION – I

Q-1 Attempt the Following questions

- What are spectral lines?
- a. b. Differentiate between Zeeman and Anomalous Zeeman effect
- c. Give the selection rule followed by hydrogen like atoms while transition from higher to lower energy levels.
- **d.** What are π and σ components of spectral lines in Zeeman Effect?
- e. Draw the vectorial diagram for LS coupling.
- f. What was the correction given by Fock to the Hartree's model for central field calculation?
- g. Define Central field.

Q-2 Attempt all questions (14) **a.** Discuss on L-S coupling and deduce the expression for interaction energy. 08 06

b. Explain the Paschen-Back effect.

OR

Q-2		Attempt all questions	(14)
	a.	How Vector Atom model helps to explain Anomalous Zeeman Effect?	07
	b.	Discuss the Thomas-Fermi model to understand Central field approximation	07
Q-3		Attempt all questions	(14)
c	a.	Justify the spitting in Normal Zeeman Effect classically.	08
	b.	Discuss in detail the Hartree's theory for Central Field estimation	06
		OR	

Q-3	a.	Write a note on Central Field Approximations	06
	b.	Derive the interaction energy term for JJ coupling	08



SECTION – II

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Q-4 Attempt the Following questions

- **a.** State difference between stimulated and spontaneous emission.
- **b.** What are Einstein coefficients?
- c. Which one is better VBT or MOT? Why?
- **d.** Give the condition for molecules to be "Oblate"
- e. Write the expression for the rotational term for a non-rigid rotator.
- f. What do you mean by reduced mass?
- g. Give one example for spherical top molecule.

Q-5	Attempt all questions		(14)
	a.	Explain the processes of absorption and emissions of radiations in atoms.	08
	b.	Write a note on life time of an excited state.	06

OR

a.	Discuss in detail on the Einstein coefficients.	08
b.	Explain the rigid rotator model as a model for rotating diatomic molecule.	06

Q-6		Attempt all questions	(14)
	a.	Explain in detail the Born-Oppenheimer Approximation	10
	b.	Give an account on diatomic molecule as a Harmonic Oscillator	04

OR

Q-6 Attempt all Questions

Q-5

- a. VBT and MOT can explain the bond formation in molecules up to a great extent.08 Comment on this statement with proper justification
- **b.** Explain in detail the classification of molecules on the basis of moment of inertia. **06**



