

MCA-1603010602020600 Seat No. _____

M. Sc. (Sem. II) (W.I.F. 2016) Examination

April / May - 2018 CT-06: Physics

(Atomic & Molecular Physics) (New Course)

Time : $2\frac{1}{2}$ Hours]

[Total Marks: 70

Instructions: (1) All questions carry equal marks.

- (2) Full marks are indicated at the right end of each question.
- (3) Symbols have their usual meanings.
- 1 Answer any seven of the following:

14

- (a) What should be the value of total angular quantum number for an s-electron and a p-electron ?
- (b) Write down the term symbol for a system
 - (i) $S = \frac{1}{2}$ and L = 2
 - (ii) S = 1 and L = 1.
- (c) State the intensity rules for the most intense and less intense spectral line.
- (d) What is normal longitudinal and normal transverse Zeeman effect?
- (e) What are homo and hetero-nuclear molecules? Give at least two examples of each.
- (f) How the moments of inertia of a molecule changes through isotopical substitution?
- (g) Draw the energy level correlation diagram for asymmetric rotor.
- (h) What is the role of "Detector" in microwave spectrometer?
- (i) What is the IR region of electro magnetic spectrum? How it is subdivided? Write the usefulness of each sub-division.
- (j) What is the role of source of radiation in IR spectrophotometer?

71110	wer any two or the following.	
(a)	Discuss in detail : Fine structure of Hydrogen atom spectrum.	7
(b)	State the building rules and explain how each rule works.	7
(c)	Discuss the spectrum of hydrogen like species by considering the example of lithium.	7
(a)	What is Paschen Back effect ? Discuss in detail.	7
(b)	What is Zeeman effect? How it can be categorized? Discuss its experimental arrangement with figure.	7
	OR	
(a)	How the molecules are classified based on the relative values of principal moments of inertia? Give at least two examples of each class.	7
(b)	Discuss non-rigid rotator in detail. Also compare the energy levels and spectrum of rigid and non-rigidrotators.	7
Ans	wer any two of the following:	
(a)	Discuss symmetric top molecules in detail showing the schematic representation of energy levels and transition for the rigid prolate and rigid obtain symmetric rotors.	7
(b)	What is stark effect ? Discuss the first order stark effect of a symmetric top molecule for the J=1, $K=1 \rightarrow J=2$, $K=1$ transition.	7
(c)	Explain the working of each part of Microwave spectrometer with the help of block-diagram.	7
Wri	te short notes on any two of the following:	
(a)	Vibrating Diatomic molecule.	7
(b)	IR spectrophotometer.	7
(c)	Normal vibrations of ${\rm CO_2}$ and ${\rm H_2O}$ molecules.	7
(d)	Selection Rule and Intensity Rule.	7
	(a) (b) (c) (a) (b) (a) (b) (c) Wri (a) (b) (c)	 spectrum. (b) State the building rules and explain how each rule works. (c) Discuss the spectrum of hydrogen like species by considering the example of lithium. (a) What is Paschen Back effect? Discuss in detail. (b) What is Zeeman effect? How it can be categorized? Discuss its experimental arrangement with figure. OR (a) How the molecules are classified based on the relative values of principal moments of inertia? Give at least two examples of each class. (b) Discuss non-rigid rotator in detail. Also compare the energy levels and spectrum of rigid and non-rigidrotators. Answer any two of the following: (a) Discuss symmetric top molecules in detail showing the schematic representation of energy levels and transition for the rigid prolate and rigid obtain symmetric rotors. (b) What is stark effect? Discuss the first order stark effect of a symmetric top molecule for the J=1, K=1→J=2, K=1 transition. (c) Explain the working of each part of Microwave spectrometer with the help of block-diagram. Write short notes on any two of the following: (a) Vibrating Diatomic molecule. (b) IR spectrophotometer. (c) Normal vibrations of CO₂ and H₂O molecules.