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( 5th Semester )

PHYSICS

EIGHTH (A) PAPER

( Spectroscopy )

( Pre-revised )

Full Marks : 55

Time : 2½ hours

( PART : B—DESCRIPTIVE )

( Marks : 35 )

*The figures in the margin indicate full marks  
for the questions*

1. (a) State and explain the basic postulates of Bohr's atomic model. Derive the expression for total energy of an electron. 2+5=7

Or

- (b) Discuss the Sommerfeld's elliptical model of an atom and obtain the fine structure of H-line. 5+2=7

2. (a) State and explain Pauli's exclusion principle. On the basis of this principle, how do you calculate the number of electrons that can occupy a sub-shell inside an atom? 1+2+4=7

Or

- (b) What are normal and anomalous Zeeman effect? Give the classical interpretation of normal Zeeman effect and derive the expression for Zeeman shift. 2+3+2=7

3. (a) What is population inversion in LASER system? Explain the mechanism of getting population inversion in three-level system. 2+5=7

Or

- (b) With necessary diagram, explain the construction and working of any one of the following : 7
- (i) He-Ne LASER
- (ii) Semiconductor LASER

4. (a) With necessary diagram, obtain an expression for the energy level, frequency of spectral line and the selection rule in non-rigid rotator. 3+3+1=7



**Subject Code :**  
**PHY/V/08 (a) (PR)**

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**Booklet No. A**

Date Stamp .....

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**To be filled in by the Candidate**

DEGREE 5th Semester  
(Arts / Science / Commerce /  
..... ) Exam., **2017**

Subject .....

Paper .....

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**INSTRUCTIONS TO CANDIDATES**

- 1. The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.**
- 2. This paper should be ANSWERED FIRST and submitted within 45 minutes of the commencement of the Examination.**
- 3. While answering the questions of this booklet, any cutting, erasing, overwriting or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.**

**To be filled in by the Candidate**

DEGREE 5th Semester  
(Arts / Science / Commerce /  
..... ) Exam., **2017**

Roll No. ....

Regn. No. ....

Subject .....

Paper .....

Descriptive Type

Booklet No. B .....

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Examiner(s)*

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Invigilator(s)*

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**PHY/V/08 (a) (PR)**

**2 0 1 7**

( 5th Semester )

**PHYSICS**

EIGHTH (A) PAPER

**( Spectroscopy )**

( Pre-revised )

( PART : A—OBJECTIVE )

( Marks : 20 )

*The figures in the margin indicate full marks for the questions*

SECTION—A

( Marks : 5 )

Tick (✓) the correct answer in the brackets provided :  $1 \times 5 = 5$

**1.** The radius of Bohr's second orbit for hydrogen atom is

(a) 0.053 nm ( )

(b) 0.106 nm ( )

(c) 0.212 nm ( )

(d) 0.318 nm ( )

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2. Stark effect is splitting of atomic spectral lines due to the application of

(a) external photon energy ( )

(b) internal photon energy ( )

(c) external electric field ( )

(d) external magnetic field ( )

3. Which of the following is correct about Einstein's A and B coefficients in a LASER system?

(a) Coefficient A is related to spontaneous emission and coefficient B is related to absorption and stimulated emission ( )

(b) Coefficient A is related to spontaneous emission and absorption and coefficient B is related to stimulated emission ( )

(c) Coefficient A is related to spontaneous and stimulated emission and coefficient B is related to absorption and emission ( )

(d) Coefficient A is related to absorption and stimulated emission and coefficient B is related to spontaneous emission ( )

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4. The zero point energy of a vibrating diatomic molecule is (here  $\omega_{os}$  is oscillating frequency)

(a)  $\frac{1}{4} h\omega_{os}$  joule ( )

(b)  $\frac{1}{2} h\omega_{os}$  joule ( )

(c)  $h\omega_{os}$  joule ( )

(d)  $2h\omega_{os}$  joule ( )

5. If one electron is removed from  $O_2$  molecule, it will be in one of the highest energy ( $\pi_g^*2p$ ) orbitals, this electron is called

(a) anti-bonding electron ( )

(b) bonding electron ( )

(c)  $\pi$ -bonding electron ( )

(d)  $\sigma$ -bonding electron ( )

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SECTION—B

( Marks : 15 )

Answer the following questions :

3×5=15

1. Define Larmor's theorem.

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2. What is Auger effect? Explain the emission of Auger electron.

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3. What are the properties of LASER?

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4. Explain the basic idea of Born-Oppenheimer approximation.

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5. What is Fortrat diagram? What information are given by this diagram?

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