

AE-746

M.Sc. (Previous)
Term End Examination, 2016-17

PHYSICS

Paper - II

Quantum Mechanics, Atomic and Molecular Physics

Time : Three Hours] [Maximum Marks : 100
[Minimum Pass Marks : 36

Note : Answer **all** questions. The figures in the right-hand margin indicate marks.

1. What do you know by harmonic oscillator ? Derive equation for it. Solve one-dimensional Schrodinger equation to find its energy eigenvalues and eigenfunction. Discuss eigenfunction in detail and also describe zero point energy. 2+2+12+2+2

OR

- (a) Solve One-dimensional Schrodinger equation for particle in a box. 10

(2)

- (b) Solve One-dimensional Schrodinger equation for potential energy of a particle having $E < V_0$ for

$$\begin{aligned} v(x) &= 0 \text{ for } x < 0 \\ &= V_0 \text{ for } x \geq 0 \end{aligned} \quad 10$$

2. What do you know by the term 'degeneracy' ?
Discuss in detail Time Independent Perturbation theory for degenerate case. Show that how degeneracy can be removed ? 2+14+4

OR

Solve Schrodinger equation for spherically symmetric potentials like Hydrogen atom. 20

3. What do you know about Zeeman effect ?
Discuss in detail normal and anomalous Zeeman effect. 3+17

OR

Write short notes on the following : 10+10

- (a) Spectra of alkali elements
(b) Spin-orbit interaction and fine structure in alkali spectra

4. Discuss in detail about interaction energy in LS -coupling and jj -coupling. Discuss hyperfine structure also. 15+5

OR

(3)

Discuss rotational spectra of diatomic molecules as rigid rotator. How is it different from spectra of non-rigid rotator ? 12+8

5. Write short notes on any **two** of the following : 20

- (a) Adiabatic and sudden approximation
 - (b) Transition probability for absorption and induced emission
 - (c) Symmetric and anti-symmetric wave functions of identical particles
 - (d) WKB approximation
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