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.

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1. What do you know by harmonic oscillator ? Derive equation for it. Solve one-dimensional Schrodinger equation to find its energy eigen-values and eigenfunction. Discuss eigen-function 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

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

$v(x) = 0$ for $x < 0$

$= V_0$ for $x \geq 0$ 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

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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