74602

M. Sc. Physics 2nd Semester
Examination – May, 2016

QUANTUM MECHANIC - II

Paper : VI

Time : Three Hours]   *[Maximum Marks : 80*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note :   Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) What do you mean by Sudden Approximation ?   4

   (b) Explain why forbidden transitions take place.   4

   (c) What do you mean by scattering cross-section ? Write relation between scattering cross-section and scattering amplitude.   4

   (d) Give the spin states of two electron system.   4

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UNIT – I

2. Using time dependent perturbation theory obtain the Fermi Golden rule for harmonic perturbation for both induced emission and absorption. 16

3. Describe WKB method for the solution of Schrödinger wave equation in a potential field and discuss it's validity. 16

UNIT – II

4. Obtain the transition probability for absorption and induced emission when electromagnetic radiation interacts with matter. 16

5. (a) Describe electric dipole transitions and obtain selection rules. 8

   (b) What are Einstein's A & B coefficients ? Obtain relation between them. 8

UNIT – III

6. Construct Green's function for a free particle. Use it to write the total wave functions in the first Born Approximation. 16

7. Derive an expression for total cross-section for scattering by a hard sphere. Show that in the high energy limit this cross-section in twice the classical values. 16

UNIT – IV

8. Construct symmetric and antisymmetric wave functions for three spineless identical particles. Show that antisymmetric wave functions obeys. Pauli's exclusion principle. 16

9. (a) Explain why the ground state of helium atom exists in para form whereas the excited state come in both form. 8

   (b) Calculate differential cross-section between two identical bosons of spin zero. 8

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