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SB-3517

M. Sc. (Part - II) Examination

March / April – 2011

Physics : Paper - II

(Specialization : Theoretical Physics)

Time : **3** Hours] [Total Marks : **70**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **M. Sc. (Part - 2)**

Name of the Subject :

☛ **Physics -2**

☛ Subject Code No. : **3 5 1 7** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Use separate answer book for each section.
(3) Symbols used have their usual meaning.
(4) Figures to the right indicate full marks.

SECTION-I

1 (a) What are the corrections required to the central field approximation ? Explain it in detail. **3**

(b) Write a note on : Thomas Fermi Atom. **4**

(c) Why do you need to quantize the radiation ? Explain it in detail. **4**

2 (a) Derive the Hartree-Fock wave equations for single electron moving in the field produced by the nucleus and the average field of the other electrons. Also generalize it for N-electron system and explain Fock operator. **7**

(b) Using variational method, calculate the ground state energy of Helium atom. **5**

OR

2 (a) In the case of complex l- plane, describe Regge poles and trajectories. **7**

(b) Evaluate the differential cross section for Raman Scattering. **5**

3 (a) Derive the zeroth order Born-Oppenheimer approximation to the eigenfunctions. Also explain the adiabatic approximation and its validity. **7**

(b) Calculate the coulomb and exchange integrals of excited 2p state for helium atom in atomic units. **5**

OR

3 (a) Derive Saha ionization formula and apply it to Hydrogen atom. **7**

(b) State and prove Nyquist theorem. **5**

SECTION-II

4 (a) Write the equal time commutation relations of canonically conjugate field variables in the continuum limit. **2**

(b) Draw the Feynman diagram for Compton scattering. **2**

(c) Define the number operator in terms of the creation and annihilation operators. And evaluate $\left[\hat{N}(k), \hat{a}^{+}(k)\right]$. **4**

(d) What are Goldstone bosons ? Give few examples. **3**

5 (a) With the help of Covariant perturbation theory derive the S matrix and apply it in the case of scattering of electrons by an external field A_μ . **7**

(b) Discuss the Feynman rules in momentum space. **5**

OR

5 (a) Explain Lamp shift with the help of higher order corrections in QED. **7**

(b) Write the Feynman amplitude for electron-electron scattering in the lowest order. **5**

6 (a) Using the SU(2) representation derive the strong decay amplitude for $\Delta \rightarrow N\pi$. **7**

(b) Explain how the spontaneous breaking of global symmetry based on Goldstone model. **5**

OR

6 (a) Give brief introduction about the standard model and discuss in detail the electroweak theory of Leptons. **7**

(b) Discuss with sufficient mathematical detials the properties of Lie algebra for U(n). **5**
