CSM : 18

PHYSICS

PAPER - II

Time Allowed : 3 hours   Full Marks : 100

Marks for each question is indicated against it.

Attempt <u>any 5 (five)</u> questions taking not more than 3 (three) questions from each Part.

PART - A

1. (a) What is Heisenberg's uncertainty principle? On the basis of this principle show that an electron cannot exist inside a nucleus.   **(3+3=6)**

    (b) Write the time independent Schrodinger equation for a particle in a one dimensional box of lenght L with an infinite potential barrier and solve it. Find the expressions for the Fermi energy and density of states. Plot the first three eigen states.   **(7+2+2+3=14)**

2. (a) Obtain expressions for the Reflection coefficient R and Transmission coefficient T by a single step potential and hence show that T+R=1.   **(5+5+4=14)**

    (b) Express the components of angular momenta in Cartesian coordinate and show that $[L^2, L_Z]= 0$.   **(3+3=6)**

3. (a) Describe with necessary theory Stern-Gerlach's experiment and discuss its significance.
                                                                                          (10+2=12)

    (b) Explain L-S and J-J coupling in an atomic system.   **(4+4=8)**

4. (a) Discuss the vibrational spectra of a molecule treating it as an anharmonic oscillator.
                                                                                               (12)

    (b) What is Raman effect? What is the advantages of using lasers sources in the study of Raman effect?   **(8)**

PART - B

5. (a) Explain Shell model of nucleus. Give two evidences of shell structure in nuclei. Discuss the successes and limitations of this model. **(4+2+4+2=12)**

    (b) What is a beta decay? What were the reasons for postulating a new particles (neutrino) to explain beta decay? **(5+3=8)**

6. (a) Explain how the elementary particles are classified on the basis of 'Masses', 'Interaction' and 'Statistics'. **(2+2+2=6)**

    (b) What are baryon number and lepton numbers? Explain with examples how they are conserved in nuclear reaction? **(2+2+5=9)**

    (c) Given the mass difference between a proton and a neutron to be 1.30 Mev, find the maximum kinetic energy of the electron emitted in the b decay of the free electron. **(5)**

7. (a) What is ferromagnetism? Discuss Weiss theory of ferromagnetism and explain how susceptibility varies with temperature above Curie temperature. **(3+8=11)**

    (b) Give three main characteristics properties of a superconductors. What are type I and type II superconductors? Explain Meissner effect. **(3+3+3=9)**

8. (a) With a suitable circuit diagram, explain the theory of a single stage transistor amplifier and hence derive expressions for the voltage and power again. **(1+3+3=7)**

    (b) What are oscillators? State the necessary condition for working of an oscillator and explain the principle of working of a typical oscillator. **(1+1+3=5)**

    (c) State and explain De' Morgan's laws. **(2+6=8)**

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