(Atomic Physics, Nuclear Physics, Solid State Physics)

Time : *2* Hours]   Paper code → 8939   [Total Marks : 75

Instructions :   (i)   Symbols have their usual meaning.
              (ii)   Figures on right hand side show marks of that question.

Q:1: (a) Discuss the normal Zeeman effect using vector atom model. Derive equation of frequency of splitted spectral line under influence of strong magnetic field.   [10]

(b) Describe the experimental set-up of Stark-effect.   [09]

OR

Q:1: (a) What is Paschen-Back effect ? Derive an expression for change in energy and discuss the transitions for lithium D1, D2 line.   [10]

(b) The Cadmium red line of wavelength $\lambda = 6438$ Å (P $\rightarrow$ S Transition) exhibits Normal Zeeman splitting when placed in uniform magnetic field of 8 Tesla. Calculate the wavelength of three Zeeman components and separation between them.   [05]

(c) Calculate the Lande g factor for $^{10}H_{1/2}$ and $^{10}G_{1/2}$.   [04]

Q:2: (a) Derive the semi empirical Binding Energy formula in the case of liquid drop model.   [10]

(b) Discuss the applications of NMR in Physics.   [09]

OR

Q:2: (a) Discuss nuclear shell model with the explanation of magic numbers.   [10]

(b) Write note on "Standard Model of Elementary Particles".   [05]

(c) Explain the term "Nuclear Isomers" and "Stripping Reaction".   [04]

Q:3: (a) Derive dispersion relation for diatomic lattice in 1-d and prove that medium actsas continuous medium for lower frequencies.   [12]

(b) Describe in detail the Kronig-Penney Model.   [07]

OR

Q:3: (a) Mention the drawbacks of classical theory and Einstein's theory of specific heat , discuss Debye's Approximation. Write the formula of average energy of

a solid according to Debye's theory and prove that for high temperatures it fellows the classical nature and for low temperature it follows the T^3 nature.[14]

(b) Discuss the effect, of temperature and magnetic field on superconductivity. [05]

Q:4: (a) What is meant by the free electron gas model of metals ? Mention the failures of classical theory of free electron gas. [10]

(b) State and prove Bloch-theorem of band theory of solid. [08]

OR

Q:4: (a) Discuss F-H Landon theory and derive F-H Landon equations to explain Zero resistivity and diamagnetic behavior of superconductors. [13]

(b) Mention outstanding properties of superconductors. [05]

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