



Time : 3 Hours

Full Marks : 350

The question paper contains 18 (Eighteen) questions to GROUP-A, (12) and GROUP-B, (06) together.

GROUP-A

Candidates to attempt 10 (ten) questions within word limit of 250.

Each question carries 15 marks.

1. Discuss in detail the applications of Mössbauer and NMR spectroscopy.
2. Find the de Broglie wavelength in angstroms for an electron of energy V eV and potential difference of 125 kV. By modifying recursion formula, prove that energy levels of harmonic oscillator are equally spaced.
3. Derive Schrödinger's time-independent equation for matter waves. By using that prove $H\psi = E\psi$.
4. What are elementary particles? Briefly discuss the classification of sub-nuclear particles.
5. Define coordination number. Compute the same for simple cubic, BCC and FCC structures. Also prove that the distance between nearest neighbours are a , $\frac{a\sqrt{3}}{2}$ and $\frac{a}{\sqrt{2}}$ respectively.

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6. With a neat schematic diagram, discuss the principle of operation of MOSFET.
7. Discuss in detail about L-S coupling.
8. Discuss the various conservation laws associated with elementary particle reactions of decay with examples.
9. Solve the Schrödinger equation in three-dimensional deep well for a free particle.
10. Discuss the Meson theory of nuclear forces.
11. Classify the power amplifiers and discuss the collector current waveforms.
12. Discuss the types of superconductors with suitable magnetisation curves.

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GROUP—B

Candidates to attempt 05 (five) questions within word limit of 300.

Each question carries 20 marks.

13. Briefly explain the fundamentals of Baryon number, Isospin, Strangeness and quarks using Gell-Mann-Nishijima scheme.
14. Deduce the necessary expressions for the frequency spectrum in an amplitude modulation. Sketch the schematic diagram of superheterodyne receiver and discuss the various amplifiers used in the receiver.
15. With a neat schematic diagram, briefly explain a breeder reactor.

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- ✓ 16. The electron of the hydrogen atom is in its ground state. Determine $\langle r \rangle$, $\langle r^2 \rangle$ and the most probable value of r for this case.
17. How do fluorescence and phosphorescence occur? Discuss.
18. Discuss in detail, the Stern Gerlach experiment.
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