Paper II
PHYSICS
(Subjective)

PHYSICS

PAPER- II

Time- 3 Hours **Full Marks- 100**

This paper will consist of descriptive type questions. 4 Questions will be set from Group-A, out of which only 2 questions have to be answered. Group-B will be divided into three sections. 6 questions will be set from each section of Group-B, out of which only 3 questions have to be answered from any one of the sections chosen by the examinee. Each question of both the Groups will carry 20 marks.

Group – A

Number systems and codes, binary arithentic, logic gates AND, OR, NAND, NOR, NOT, XOR Boolean theorems, De-morgan theorems, Minterm and Manterm representation, simplification using Boolean algebra theorems and K-maps, half and full address flip flops- Rs and JK. Elementary ideas of Registers, counters and comparators.

Group –B

Section I

Time independent perturbation theory for discrete level- non degenerate cases, removal of degeneracy spin orbit coupling, Fine structure of Hydrogen variation method, Time dependent perturbation theory constant and periodic perturbation. Fermi golden rule WKB approximation sudden and adiabatic approximation.

Section III

Atomic Physics- Vector atom model (Ls, JJ Coupling) Fine structure and Hyperfine structure, Zeeman effect, paschan- Back and stork effect.

Intensity, shape and width of spherical lines, Independent particle model, The atom as an approximation for many electron atomic systems, slater determinants to write possible multiplates.

Group –B

Section – I: The theory of Nuclear and Particle Physics

(special paper)

Relativistic quantum mechanics, K.G. equation, Dirac equation and its covariance, Algebra of gama matices and their representation, Dirac spinors, projection operators, Dirac covariants, Two component theory of neutrino.

Quantization of free scalar, Dirac and electromagnetic fields, Particle number representation, Lippman Schwinger equation for scattering states (in and out states).

S-matrix and T-matrix, Born series for scattering Phase shift under Born and Eikonal approximation, Kramers-kroning dispersion relations, Mandelstam representation, Dispersion relation for forward potential scattering amplitude, Interaction picture, Dysons covariant perturbation theory of s-matrix, Feynaman graph, Mott scattering.

Properties of free field and transition under gauge transformation, continuous displacement, rotation, reflection, parity, charge conjugation, Properties of free field and transition under gauge transformation, continuous displacement, rotation, reflection, parity, charge conjugation, time reversal, isospin, SU(2) and its application.

Section-II: Solid State Physics (Special paper)

Lattice Waves and free electron Fermi gas: Quantization of lattice waves, phonons, scattering of phonons, Debye-Waller factor, Band structure calculations, Fermi surface studies by cyclotron resonance and de Hass-Van Alphen effect.

Dynamics of electrons and electron-electron interaction:

Wannier function and equation of motion in Wannier representation, Screening of electron by impurities, quantum theory of screening, the Friedal sum rules.

Transport properties optical properties:

Boltzmann equation, electrical and thermal conductivities of metals Bloch-Gruneisen law, complex refractive index, Kramers- Kroning relations, Drude theory, Anomalous skin effect.

Energy Bands in Semiconductors and Magnetis:

Carrier concentration at thermal equilibrium, Drift mobility and Haynes-Shockley experiment, Shockley-Read theory of recombination, Landau quantization, Thermal excitation of magnons, Ising model and its exact solution.

Superconductivity:

B.C.S. theory of superconductivity, superconducting ground state, cooper pairs, Josephson effect.

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Dean, Science