**SEMESTER V ATOMIC AND QUANTUM MECHANICS CORE SUBJECT - 5**

Unit I

Introduction – Bohr atom model (No derivation) – Application of Bohr's theory – Excitation and ionization of atoms. Sommerfield relativistic atom model – Elliptical orbits – Relativistic variation of aromicamass – application to the fine structure of spectral lines, vector atom model – spatial quantization and spinning electron hypothesis – Stern and Gerlach experiment – Quantum numbers – coupling schemes – Pauli's exclusion principle – electronic structure of atoms.

Unit II

X-rays – characteristics X-ray – its properties – application – Duane and Hunt law – Mosely's law and its importance. Compact effect – Theory and experiment verification. Zeeman effect – theory and experiment – Anomalous Zeeman effect – Stark effect (Qualitative only).

Unit III

Introduction – black body radiation – Planck's Quantum theory of absorption and emission – Limitations of classical theory – Dual nature of matter and radiation – De Broglie's hypothesis of matter waves – De Broglie's wavelength – Davisson's and Germer experiment –G.P. Thomson's experiment with relativistic correction.

Concept of packets for a quantum particle – group velocity and wave velocity & their relations – Heisenberg's uncertainty principle thought experiment illustration. Diffraction of electron through a single slit.

Unit IV

Basic postulates of wave mechanics – Derivation of time dependent & time independent – Schrodinger wave equation – wave function – Physicsl significance of wave function – Probability density and expression for probability current density – Eigen function and Eigen value – Energy function – Expection value – Normalization of wave function of simpler types – orthogonal and orthonormal properties of wave function.

Unit V

Schrödinger equation for a free particles in one dimensional potential well, its eigen function and eigen values – Application of Schrodinger wave equation – Particle in one dimensional box – the barrier penetration problem – Linear harmonic oscillator – Zero point energy.

**Book for study:**

Quantum mechanics – R. SAthyaprakah, Ratan Prakasan Mandir – 1994.

Modern Physics – R. Murugesan , S.Chand & C0 1998.

Modern Physics – Seghal Chopra & Seghal Sultan, Chand, 1998.

**Reference Books:**

Quantum Mechanics – Gupta & Kumar Jay Prakash Nata & Co, 2007.

Mechanics – D. S. Mathur, S.Chand & Co, 2002.

## NUCLEAR PHYSICS CORE SUBJECT 6

Unit I

Isotopes – Isotones – Isobars – Atomic mass unit – Properties of the nucleus – Nuclear binding Energy – Nuclear forces – Yukawa's theory (no derivation) – theories of nuclear composition – proton – electron hypothesis – Model of nuclear structure – the liquid drop model – Binding energy formula – Shell model – Collective model.

Unit II

Particle Accelerators – Synchro-cyclotron – Betatron – proton synchrotron – electron synchrotron – detectors – Wilson cloud chamber – bubble chamber – photographic emulsion technique – fundamental particles – particles and antiparticles – particles instability – conservation laws.

Unit III

Laws of radio activity – Half life period – Mean life – Radio Carbon dating – alpha rays – Geiger Nuttal law – experimental determination by Geiger Nuttal law – a integration energy – theory of alpha, beta rays, beta rays spectra – origin – neutrino theory of beta decay – electron capture, gamma rays – determination of wavelength by diamond crystal spectrometer – origin of rays – internal conversion.

Unit IV

Nuclear transmutations by alpha particles, protons, deuterons, neutrons and electrons – Photo disintegration – Nuclear fission – energy release. Explanation – (C.N Cycle and P.P Cycle) Nuclear fusion – Thermo nuclear reaction – Controlled thermo nuclear reaction – Cosmic rays – Origin – Primary -Secondary – Azimuthal effect – East-West effect pair production & annihilation – Van Allen Belt.

Unit V

Utilisation of nuclear energy – Principle and action of atom bomb & Hydrogen Bomb – Production of electricity from energy – Nuclear reactors – General features of nuclear reactors – Different types of nuclear reactors – Pressurized water reactors – Boiling water reactors – Fast Breeder reactors – Radio isotopes and their application.

**Book for study:**

Modern Physics – R. Murugesan , S.Chand & C0 1998.

Modern Physics – Seghal Chopra & Seghal Sultan, Chand, 1998.

Nuclear physics – Keplan I., Marosa Publishing House, 1995.

**ANALOG ELECTRONICS** **CORE SUBJECT &**

Unit I

Thevenin's theorem – Norton's theorem – two port network – Analysis – 'h' parameter only – Filter circuits – General theory – low pass, high pass, Band pass and band elimination filters.

Unit II

Transistors – three type of configuration - relation between alpha, beta and gamma – Load line (DC and AC) and operating point – Biasing circuits – base bias – collector feedback bias – voltage divider bias – FET characteristics.

Unit III

Small signal CE amplifier – calculation of voltage gain, current gain and power gain – input & output impedence using h parameter – frequency response of amplifier – Sinle stage amplifier – push pull amplifier – OP AMP characteristics – applications as adder, subtractor – integrator and differentiator.

Unit IV

Feedback – Positive & Negative feedbacks – Barkhausen's criterion – transistor – oscillators – Hartley, Colpitt & phase shift oscillator with mathematical analysis

Unit V

Modulation – types of modulation – Amplitude modulation – modulated power output – modulation index – frequency modulation – digital modulation – block diagram of AM & FM transmitters.

**Book for study:**

Principles of Electronics – V.K. Metha S.Chand & Co., 2002

Basic Electronics – B.L. Theraja S.Chand & Co., 2003

Electronic Devices & Circuits – Salivahanan , Sureshkumar, Vallavaraj, Tata Mc Graw Hill -2004.