GITAM SCHOOL OF SCIENCE

PhD Entrance Test Syllabus

PhD in Science: Physics

Unit-I
Classical, Quantum and Statistical Mechanics

Classical Mechanics

D-Alembert's Principle, Lagrange's equation,. Hamilton's equation of motion and conservation theorems. Euler angles,Canonical transformation and Poisson brackets.

Quantum Mechanics

General formalism of wave mechanics Schrödinger's wave equation, Angular momentum operators, Time independent and dependent perturbation theory. Scattering phenomena, differential – cross section and Born approximation.

Statistical Mechanics

Postulates of statistical mechanics, probability calculations and general interaction between systems. Ensemble- its types- probability calculations, mean energies and dispersions of ensembles. Quantum Statistics .Equation of state for Ideal Bose and Fermi gas, Bose -Einstien condensation, Theory of white dwarf stars

Unit-II Electrodynamics

Electromotive force-ohm's law, EMF, Motional EMF Electromagnetic induction –Faraday laws, induced electric field, Inductance, Energy in magnetic fields. Maxwell equations- magnetic charge, Maxwell equations in matter, Charge and Energy equation, Pointing theorem Electromagnetic Theory.

Unit-III
Solid State Physics & Nuclear Physics

Crystal structure, LatticeVibrations -mono and Diatomic,specific heat theories- Einstein and Debye theories. Energy bands in solids- Kronig penney model, Concept effective mass. Polarisability- theory of electronic, ionic and orientational polarization and Classification of magnetic materials**.**

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Nuclear Physics

General properties of Nuclei, Scattering of α-particles – Experimental verification – Nuclear size – Theories of nuclearcomposition,– Binding energy – semi empirical mass formula and applications. Interaction of gamma rays with matter – photo electric effect, Compton effect, pair production. Detection of nuclear radiation- ionization chamber and proportional counter. Nuclear Fission and Fusion

Unit-IV

Low dimensional Physics

Electromagnetic Spectrum, Molecular energies, Classification of molecules, Rotational, vibrational and vibrational- rotational spectra of diatomic molecules, Characteristic group absorptions, IR spectrometer, Electronic Spectra, Frank Condon principle,Hydrogen atom-spectrum, Orbital angular momentum, Larmor precession, Stern and Gerlach experiment, Energy levels and transitions in Helium atom, Normal and anomalous Zeeman effect

Unit-V

Electronics

Basics of semiconductor; p-n junctions, diodes, transistors, device structure, device characteristics, frequency dependence and applications. Opto-electronic devices (solar cells, photo-detectors, LEDs), LCR circuits, rectifiers, amplifiers, active Filters and oscillators. Basics of OPAMPs and their applications. Basics of digital electronics-Logic gates, Flip Flops, Registers and Counters.