KUVEMPU UNIVERSITY

Jnanasahyadri Shankarghatta-577451

P. G. Department of studies & Research in Physics,

Syllabus for Ph.D Entrance Examination-2020

Question Paper Pattern

No	Type Questions	Research Methodology	Cognate Subjects	Marks per question	Total Marks
1	Objective-multiple choice	10	10	1	20
2	Short notes type (Answer any five)	4	4	6	30
3	Essays type (Answer any four)	3	3	10	40
Maximum Marks for written entrance exam is 90					
4	Viva Voce				10
Total Marks					100

Research Methodology:

Research and its importance; Research method and research methodology; Types of research; Identification of the problem; Literature survey; Reference collection; Internet Browsing; Assessing the current status; Mode and design of approach; Actual investigation; Results and discussion; Conclusion; Presentation of a scientific paper; Multimedia techniques in paper presentation; Art of writing a research paper and a thesis.

Classical Mechanics:

Constraints and their classification; Degrees of freedom, Generalized coordinates and velocities. Principle of virtual work, D'Alembert's principle, Generalized forces, Lagrange's

equation of motion. Properties of Lagrangian. Cyclic coordinates, Lagrangian of a simple harmonic oscillator. Simple problems using Lagragian formalism. Motion of a particle in a central force field, Conservation of energy and angular momentum, Kepler's laws of planetary motion. Hamiltionian Mechanics: Hamilton's equations of motion. Canonical coordinates, Cyclic coordinates, conservation laws. Canonical transformations, Generating functions. Poisson bracket and its properties. Hamilton's principle of least action.

Classical Electrodynamics:

Basic concepts of electrostatics and magnetostatics, Coulomb's Law, Gauss' Law, Biot-Savart Law: Time-dependent fields; Faraday's Law, Ampere's Law: Maxwell's equations; Wave equation for electromagnetic field, Poynting theorem; Scalar and Vector potentials of EM field; Gauge invariance; Coulomb Gauge, Lorentz gauge; Wave propagation in dielectrics and conductors.

Quantum Mechanics:

The classical description and the inadequacy of Classical mechanics. Dual nature of matter and waves, Double-slit experiment for photons and electrons as an illustration. Waves, wave packets, phase velocity and group velocity. Canonically conjugate variables, General uncertainty principle. Position and momentum representations. Wavefunctions. Superposition principle. Schrödinger's equation. probability densities, probability current.

Expectation values and Ehrenfest's Theorem. Continuity equation, Fundamental Postulates of Quantum Mechanics. Commutators. Eigenvalues and eigenvectors of a complete set of mutually commuting operators. Angular Momentum: Concept of Spin: Stern Gerlach experiment: Addition of angular momenta: Clebsch Gordan coefficients; Singlet and Triplet states;

Simple Harmonic oscillator: Ground, excited state wave functions and energy levels;

Hydrogen atom; Ground and excited state wave functions and energy levels;

Statistical Mechanics:

Basic concepts of probability theory; Joint and conditional probabilities;

Concept of an ensemble; Types of ensembles; Micro and macrostates; Postulate of equal a priori probability, Ergodic hypothesis; Liouville theorem;

Partition function and its significance; Rotational, vibrational and electronic partition functions. Meaning of distribution function: Maxwell, Bose-Einstein and Fermi-Dirac distribution functions: Classical limit; Bose-Einstein condensation.

*****