

Syllabus for Ph.D. Entrance Exam (Physics) for session 2020-21 (UIET, KUK)

Instructions for the Paper Setter:

1. All the questions will be of multiple-choice.
2. Section-1 shall consist of 30 and Section-2 shall consist of 70 multiple-choice questions.
3. Each question shall carry 02 marks.
4. Total marks: 200 (Section-1 : 60 Marks; Section-2 : 140 Marks)

Section - 1 Research Methodology

Introduction: Meaning, objectives and types of research, Research approaches, Significance of research, Research methods versus methodology, Research and Scientific Method, Research Process, Criteria of good research.

Data Collection: Experiments and surveys, Collection of primary and secondary data, Selection of appropriate methods of data collection.

Data Preparation: Data preparation process: editing, coding, classification, tabulation, graphical representation, data cleaning, data adjusting; Problems in preparation process, Missing values and outliers, Types of analysis, Statistics in Research.

Descriptive Statistics: Measures of central tendency: mean, median, mode, other averages; Measures of dispersion: range, mean deviation, standard deviation; Measures of skewness and Kurtosis.

Propagation of Errors: Standard error of a sum, difference, product and compound quantity.

Section - 2 Physics

Mathematical Methods of Physics: Vector algebra and vector calculus. Matrices, Eigen values and Eigen vectors, Linear ordinary differential equations of first and second order, Elementary probability theory, random variables, binomial, Poisson and normal distributions.

Classical Mechanics: Newton's laws, Dynamical systems, Phase space dynamics, Stability analysis, Central force motions, Two body collisions - scattering in laboratory and centre of mass frame, Conservation laws and cyclic coordinates, Periodic motion: small oscillations, normal modes, Special theory of relativity: Lorentz transformations, relativistic kinematics and mass-energy equivalence.

Electromagnetic Theory: Electrostatics: Gauss's law and its applications, Laplace and Poisson equations; Magnetostatics: Biot-Savart law, Ampere's law; Electromagnetic induction. Maxwell's equations in free space and linear isotropic media, Scalar and vector potentials, Electromagnetic waves in free space; Interference, Diffraction and Polarization.

Stiwani
10/02/2020

Jawan
10/02/2020

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Quantum Mechanics: Wave-particle duality, Schrödinger equation (time-dependent and time-independent), Eigen value problems (particle in a box, harmonic oscillator, etc.). Tunneling through a barrier, Wave-function in coordinate and momentum representations, Heisenberg uncertainty principle, Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta.

Electronics: Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices), Opto-electronic devices (solar cells, photo-detectors, LEDs), Operational amplifiers and their applications.

Condensed Matter Physics: Bravais lattices, Reciprocal lattice, Bonding of solids, Free electron theory and electronic specific heat, Drude model of electrical and thermal conductivity, Hall effect and its applications, Band theory of solids: metals, insulators and semiconductors, Superconductivity.

Nuclear Physics: Basic nuclear properties: size, shape and charge distribution, spin and parity, binding energy, semi-empirical mass formula; Nature of the nuclear forces, Elementary ideas of alpha, beta and gamma decays and their selection rules, Fission and fusion. Nuclear reactions: reaction mechanism, compound nuclei and direct reactions; Interaction of nuclear radiations with matter.

Srujan
10/02/2020

Javul
10/02/2020

Chm