AWADHESH PRATAP SINGH UNIVERSITY
REWA

(ACCREDIATED GRADE "B" BY NAAC)

FACULTY OF SCIENCES

Syllabus for

Ph. D. (PHYSICS) Entrance

With Effect From 2022-23 Onwards

Ph. D. Entrance Examination (Physics) 2022-2023

Time: 03 Hours **Max. Marks-100**

Minimum Pass Marks-50

Note: The paper setter is required to set in all 100 objective type questions, from both sections A and B(50 questions from each sections). Each question carries one mark.

Part A

RESEARCH METHODOLOGY

Unit - I

Concepts in Research: Definition and Objective, Research Approach & Types of Research, Criteria of Good Research, Defining Research Problems. Research Design: Features of Good Research Design, Research Design with reference to Physics, Basic Principles of Experimental Research Designs. Structure and components of scientific presentations, Research reports/ paper etc

Unit - II

Nature and Purpose of Mathematical Statistics, Tabulation and Statistical Inference, Tabular and Graphical Representation of Data, Mean, Median, Mode & Variance, Co-relation and Regression, Random Sampling, X^2 - Test, Method of Least squares curve, Fitting of Straight Lines & Polynomials, Data analysis using Fourier Techniques and applications.

Unit - III

Theoretical Modelling Methods: Bisection Method, General Idea of Mathematical Modelling and Simulation - Random Walk Problem, Newton Raphson Method, Least Square Fitting of Linear and Exponential Functions, Numerical Differentiations & Integration. Simpson's Rule, Runga Kutta Method.

Unit - IV

General Idea of Preparation of Materials: Solid State Reaction Method and Wet Chemical Method, Electro-Deposition Methods (Basics only),Elementary Idea of Vacuum Coating Methods, Basic Principles & Applications of XRD, SEM, and NMR. Methodology of Space Research - Ground Based & Satellite Observations, Nuclear Detectors, Methods of Extracting Scientific Information from Space Data.

Unit V

Anatomy of Digital computer, Brief overview of input and output devices, CPU-evolution of microprocessors, Semiconductor memories (RAM and ROM) : organisation and their characteristics, Cache memory, CDROM, Magnetic disk, Software Concept : types of software and their features. System utility software. Role of software in information technology. Computer language : Features of low level and high level programming languages. Mathematical and logical ability.

Reference Books:

1. Research Methodology: Methods & Techniques: C.R. Kothari, New Age International Publisher, N. Delhi (2009).
2. How to Write and Publish: R.A. Dayand, B. Gastel, Cambridge University Press.
3. How to Research: L. Blaxter, C. Hughes and M. Tight Viva Books.
4. A Student Guide to Methodology: P. Clough &, C. Mutbrown, Sage Publications.
5. Fundamentals to Computers: V. Rajaraman (PHI)
6. Probability & Statistical For Engineers & Scientists: Shelder Ren Elsevier Academic Press.
7. Principles of Instrumental Analysis: Skoog & Leary.
8. Astronomy: Baker

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Part B
(Physics)

Unit - I:

Newtonian mechanics of one and many particle system: Conservation laws, D'Almbert's principle in generalized coordinates, Lagrange's equation from D'Almbert's principle. Hamilton's principle,

The equations of canonical transformation; Poisson's brackets, and their algebraic properties, The Kepler problem, Rutherford scattering, Basic Postulates of Quantum Mechanics, Normalization and Orthogonality of wave functions, Planck's law of radiation, wave - particle duality, solution of Schrodinger equation for one dimensional (a) Potential well (b) Potential step and (c) Potential barrier.

Bessel Function, Hermite Function, Complex Variables: Analytic Function, Poles and Residues of Functions.

Unit – II BJT, JFET, MOSFET, Charge Coupled Devices, Operation and I-V characteristics, Silicon Controlled Rectifier(SCR),- structure, operation and characteristics. Photonic devices, Photo detectors, Solar cell (open circuit voltage and short circuit current, fill actor), LED , Number systems, Different logic gates, Boolean algebra and Karnaugh map, Half adder and full adder, AD/ DA converters, Flip-Flops.

Unit - III :

Specification of states of a system connection between statistics and thermodynamics, classical ideal gas entropy of mixing and Gibb's paradox. Microcanonical ensemble, phase space and density of states, Liouville theorem, canonical and grand canonical ensembles, partition function, Maxwell - Boltzmann, Fermi Dirac and Bose - Einstein statistics, properties of ideal Bose gases, Bose - Einstein condensation, properties of ideal Fermi gas, electron gas in metals, Boltzman transport equation.

Unit - IV

Biot-Savart's law, Ampere's circuital law, magnetic vector potential, magnetic field of a circular loop using vector potential, the magnetic dipole, Faradays law of electromagnetic induction, Maxwell displacement current, Maxwells equations (integral and differential forms). Power/energy flow, Helmholtz equation, Poynting vector, wave propagation in free space, dielectric and conducting Media,. Elementary concept of occurrence of plasma. Plasma parameters. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.

Unit V

Nuclear forces, exchange and tensor forces, meson theory of nuclear forces, Direct and compound nuclear reaction mechanism, Nuclear models, Basic concept of linear and cyclic accelerators, principle of phase stability, magic number, Fermi theory of β decay, nuclear isomerism. Classification of elementary particles and conservation laws, fundamental interaction, Symmetry and conservation laws, Crystal Structure: Bravais lattice in two and three dimension. Simple crystal structures, Reciprocal lattice, Relation between crystal lattice axes and crystal reciprocal lattice axes. Bragg's diffraction. Brillouin zones, Fermi energy, Fermi surface, phonons and magnons.

LASER, spontaneous and stimulated emission, Population inversion, concept of Two and Three level laser system. M

Reference Books:

1 Quantum Mechanics: Mathews & Venkatesan, L.I. Schiff, Ghatak & Loknathan
2. Statistical Mechanics: B.B. Laud, A.K.Saxena
3. Nuclear & Particle Physics: Pandya & Yadav, RC Sharma
4. Solid State Physics: AK Saxena, Ashcroft & Mermin , Azaroff
5. Laser Physics : B.B.Laud

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