

# पी.पी.एच.टी. 2022 हेतु पाठ्यक्रम

कुल अंक 150

कुल प्रश्न 150

## भौतिकी (Physics)

Units and dimensions, Dimensional analysis, S.I. Units, motion in two dimensions. Cases of uniform velocity and uniform acceleration, General relation among position and velocity. Uniform circular motion, Force and inertia, Newton's laws of motion . conservation of momentum and energy Static and kinetic friction . Work energy and power, Elastic collisions . Potential energy , Gravitational potential energy and its angular conversion to kinetic energy. Potential energy of a spring . Rigid body rotation and conservation of its momentum, Moment of inertia, theorems of parallel and perpendicular axis, (Moment of inertia of uniform ring, disc thin rod and cylinder only).

Acceleration due to gravity and its variation. Universal law of gravitation, geostationary satellites, escape velocity.

Hooke's law, Young's modulus, shear and bulk modulus, surface energy and surface tension, kinetic theory of gases, gas laws, kinetic energy and temperature.

Specific heats at constant volume and constant pressure, Mechanical equivalent of heat isothermal and adiabatic processes.

Heat conduction in one dimension. convection and radiation. Stefan's law and Newton's law of cooling.

Periodic motion, simple harmonic motion, Oscillations due to spring. Wave motion principle of super position. progressive and stationary waves, beats and Doppler effect.

Wave nature of light. Interference, Young's double slit experiment, velocity of light and Doppler's effect in light.

Reflection, refraction, total internal reflection, curved mirrors, Lenses, mirror and lens formulae. Dispersion in prism, absorption and emission spectra.

The human eye, defects of vision, magnification and resolving power of telescope and microscope.

'e' and 'e/m' for an electron, Einstein's photoelectric equation, photocells.

Bohr model of the atom, Hydrogen spectrum, Composition of nucleus, atomic masses and isotopes, radioactivity, laws of radio active decay, decay constant, half life and mean life, Mass-energy relation, fission, X-Ray : properties and uses.

Elementary ideas of conductor, semi-conductor and insulator, intrinsic and extrinsic semi-conductors, pn junction as a rectifier.

Bar magnet. lines of force, torque on a bar magnet due to magnetic field, earth's magnetic field, tangent galvanometer, vibration magnetometer.

Coulomb's law of electrostatics, dielectric constant, electric field and potential due to a point charge, dipole, dipole field, Gauss's law in simple geometrics

Electrostatic potential, capacitance, parallel plate and spherical capacitors, capacitors in series and parallel, energy of a capacitor.

Electric current, Ohm's law, Kirchoff's laws, resistances in series and parallel, temperature dependance of resistance, wheat ston bridge, potentiometer.

Measurement of voltages and currents.

Electric power heating effects of currents, chemical effects and law of electrolysis, thermoelectricity, Biot-Savart law, Magnetic fields due to a straight wire, circular loop and soienoid.

Force on a moving charge in a magnetic field (Lorentz force), magnetic moment of a current loop, effect of a uniform magnetic field of a current loop, forces between two currents; moving galvanometer, ammeter and voltmeter.

Electromagnetic induction induced emf Faraday's law. Lenz's law, self and mutual inductance. Alternating currents impedance and reactance growth and decay of current in L-R curcuit, elementary idea of dynamo and transformer.

## रसायन (CHEMISTRY)

### GENERAL AND PHYSICAL CHEMISTRY

1. Structure of Atom : Constitution of nucleus : Bohr's atom model : quantum numbers aufbau principle electronic configuration of elements (upto-kr) : de-Broglie relation, shapes of orbitals.
2. Chemical bond : Electrovalent covalent and co-ordinate bonds, hybridisation (sp): hydrogen bond : shapes of molecules (VSEPR theory) : bond polarity resonance. Elements of VBT a M.O.T.
3. Solutions: Modes of expressing concentrations of solutions : Types of solutions, Raoult's law of colligative properties, non-ideal solution, abnormal molecular weights.
4. Solid State : Crystal lattices, unit cells, Structure of ionic compounds close packed structure Ionic radii, imperfections (Point defects) : properties of solids
5. Nuclear chemistry: Radio active radiations: Half-life, radioactive decay, group displacement law, Structure and properties of nucleus : Nuclear reactions, disintegration series, artificial transmutation: isotopes and their uses: Radio-carbon dating.
6. Chemical equilibrium: Chemical equilibrium, Law of mass action  $K_p$  and  $K_c$ : Le-Chatelier principle and its applications.
7. Ionic Equilibria in solutions, Solubility product, common ion effect, theories of acids and base hydrolysis of salts: pH: buffers.
8. Thermochemistry and Thermodynamics: Energy changes during a chemical reaction intrinsic energy, enthalpy; First law of thermodynamics : Hess's law Heats of reactions; Second law of thermodynamics; entropy ; free energy; spontaneity of a chemical reaction, free energy change and chemical equilibrium; free energy as energy available for useful work.
9. Chemical Kinetic : Rate of a reaction, factors affecting the rate, rate constant, rate expression, order of reaction, first order rate constant-expression and characteristics, Arrhenius equation.
10. Electrochemistry: Oxidation, Oxidation number and ion-electron methods, Electrolytic conduction, Faraday's laws: voltaic cell, electrode potentials, electromotive force, Gibbs's energy and cell potentials. Nernst equation, commercial cells, fuel cell, electrochemical theory of corrosion.
11. Surface chemistry, Colloids and Catalysis-, Adsorption, Colloids (types preparation and properties), Emulsions, Micelles Catalysis: Types and characteristics.

### INORGANIC CHEMISTRY:

12. Principles of metallurgical operations: Furnaces, ore concentration, extraction, purification metallurgies of Na, Al, Fe, Cu, Ag, Zn and Pb and their properties.
13. Chemical periodicity: s,p,d. and f-block elements, periodic Table, periodicity, atomic and ionic radii valency, ionization energy, electron affinity, electronegativity, metallic character.
14. Comparative study of elements: Comparative, study of the following families of elements: (i) Alkali metals (ii) Alkaline earth metals (iii) Nitrogen family (iv) Oxygen family (v) Halogens (vi) Noble gases.
15. Transition metals : Electronic configuration of 3rd-Metal ions, oxidation states, other general characteristic properties, potassium permanganate, potassium dichromate.
16. Co-ordination compounds : Simple nomenclature, bonding and stability, classification and bonding in organometallics.
17. Chemical analysis: Chemistry involved is simple inorganic qualitative analysis : calculations based on acid base titrimetry.

## ORGANIC CHEMISTRY

18. Calculation of empirical and molecular formulae of organic compounds, Nomenclature of organic compounds, common functional groups, isomerism, Structure and shapes of alkanes, alkenes and benzene.
19. Preparation properties and uses of alkynes, alkenes and aldehydes, benzene petroleum, cracking, octane number, gasoline additives.
20. Nomenclature. Physical Chemical properties, correlation of physical properties with structures and uses of haloalkanes, halobenzenes, alcohols and phenols : General ideas of some polyhalogen compounds viz. dichloroethanes, dichloroethers, chloroform, carbon tetrachloride, D.D.T., benzene, hexachloride.
21. Nomenclature, methods of preparation, Chemical properties, correlations of physical properties with structures and uses of ethers, aldehydes, ketones, carboxylic acids and their derivatives. Brief account of the chemistry of Cyanides, isocyanides, amines and nitro compounds.
22. Polymers Classification : Preparation and uses of common natural and synthetic polymers.
23. Biomolecules : Classification, Structures and biological importance of carbohydrates, amino acids, peptides, proteins and enzymes, nucleic acids and lipids

## गणित (MATHEMATICS)

1. **ALGEBRA:** Algebra of complex numbers. Graphical representation complex numbers. moduls and argment of complex numbers, conjugated of a complex number Triangle inequality. Cube roots of unity. Arthmetic, geometric and harmonic progression Arithmetic geometric and harmonic means between two numbers. Sum of squares and cubes of first Natural numbers. Theory geometric equations relations between roots and coefficients. Quadratic expressions, quadratic equations in one variable, permutations and combinations, binomial Theorem (any index) exponential and logarithmics series. Determinants upto third order and their order and their elementary properties Matrices types of matrices, adjoint and inverse of matrix, elementary properties of matrices. Application in solving simultanceous equations upto three variables.
2. **TRIGONOMETRY :** Trigonometry functions and their graphs, addition and subtraction Formula involving multiple and submultiples angles, general solutions of triangles equations, Relations between sides and angles of a triangles. Solutions of triangles, inverse; trigonometrical functions, height and distance (Simple Problems).
3. **CO-ORDINATE GEOMETRY OF TWO DIMENSIONS :** Rectangular Cartesian co-ordinates. Straight line pair to straight line, dislance of a point from a line angle between two lines.  
Circle, tangents and normal system of circles.  
Conic section Payabola Ellipse and Hyperbola in standard forms with elementary. properties tangents and normals.
4. **CO-ORDINATE GEOMETRY OF THREE DIMENSIONS :** Rectangular co-ordinate system, Direction consines and direction ratios, equation of place in standard forms. Peypendicular distance from a point equation of a line angle between two lines.
5. **VECTOR ALGEBRA :** Definition of vector , addition of vectors. Components in three dimensional space. Scalar and vector products. Triple products. Simple application in geometry and mechanics.
6. **DIFFERENTIAL CALCULUS :** function polynomial, rational trigonometric, logarithmic and exponential. Inverse function, Limit continuity and differentiability of functions, differentiation of rational. trigonometrie and exponential functions. Application of derivative in elementary problems in mechanics increasing and decreasing functions. Maxima and Minima of function of one variable. Roll's theorem and mean value theorem.
7. **INTEGRAL CALCULUS :** Integrations as the inverse process of differentiation. Integration by parts. By substitution and by partial fraction. Definite integral. Areas under simple cures.
8. **DIFFERENTIAL EQUATIONS :** Formulation of differential equation, order and degree. Solution of differential equations by separation of variable method . Homogeneous form Linear differential equation of first order.
9. **STATISTICS :** Probability addition and multiplication laws. conditional probability. binomial distribution Simple problems in correlation and regression.
10. **NUMERICAL METHODS :** Solution of equation by the methods of bisection, false-position and Newton-Raphson. Numerical integration by trapezoided and Simpsons's Rule.
11. **LINEAR PROGRAMMING :** Definition and formation of linear programming problems. Solution by graphical method.

## जीव विज्ञान (BIOLOGY)

### वनस्पति विज्ञान (BOTANY) (भाग - 1)

Structural Organisation of cell, theory : Light and Electron Microscopic view of cell Structure and functions of cell organelles : Nucleus, Mitochondria. Chloroplast, endoplasmic reticulum, Golgi complex, lysosome, microbodies, microfilaments. Ribosomes. Centrioles, and plasmids. Eukaryotic Chromosome (Morphology) cell and plasma membrane. Differences between plant and animal cell Cell Division, Cell cycle significance of Mitosis and Meiosis.

Mendel's Laws of inheritance, Monohybrid and dihybrid cross; Linkage and crossing over of genetic material; DNA replication, genetic code, transcription, translation and gene regulation.

Difference between prokaryote and Eukaryotes; Structure, reproduction and economic importance of viruses, Mycoplasma, Bacteriophage, Cyanobacteria (Nostoc) and Bacteria.

Five kingdom classification; Binomial nomenclature; External morphology and life cycle of Spirogyra, Mucor, Funaria, Selaginella and Pinus.

Elementary knowledge of Microsporogenesis, megasporogenesis, Fertilisation, endosperm and embryo development in Angiosperms.

Tissue and tissue systems. Meristematic and permanent tissue. Mineral nutrition essential elements and their functions. Uptake of minerals transport of water and solutes. Transpiration Photosynthesis and Respiration-Importance, mechanism and factors affecting these processes; photorespiration.

Enzymes and growth hormones with reference to their classification. Chemical nature, mode of action and importance, Elementary idea of photoperiodism and phytochrome.

Ecosystem-Structures and function; Major ecosystems i.e. Lake and Forest; Food chain. Food Web and Energy flow. Ecological crisis-Role of man in Polluting Environment-Air, Water and Soil.

Role of plants in human welfare : A general knowledge of plant products of economic value-Drugs, Fibers, cereals

(Wheat and Rice) Pulses (gram), Oil Seeds (Ground nut). Sugarcane, Coal and Petroleum.

Food preservation Methods and importance.

Principles of plant breeding and its role in improvement of crops. Biotechnology; scope and importance in Agriculture and Industries Manufacture of cheese, Yoghurt Alcohol Antibiotics.

## प्राणीशास्त्र (ZOOLOGY) (भाग-2)

### **Multicellularity-Structure And Functions of Animal Life :**

- Structure and function of Animal tissues-Epithelial, Connective, Muscular, Skeletal and Nerve.
- Histology of Mammalian organs- Stomach, Intestine, Liver Kidney, Lung, Testis and Ovary.
- Structure and physiology of different organ systems of Human body-skin, Digestive System, Respiratory System, Circulatory System, Excretory system, Nervous system, Reproductive system.
- Skeleton, joints, Muscles on the basis of movement, Receptors.
- Endocrine system with special reference to various Endocrine glands of man and Hormonal co-ordination Vitamin & minerals (source and disorders due to deficiencies).

### **DEVELOPMENTAL BIOLOGY AND GENETICS:**

- Female reproductive cycles in mammals. Gametogenesis alongwith structure of Sperm and ovum.
- Types of eggs. Fertilization, cleavage, types of cleavage and blastula. Development of mammals upto three germinal layers, Foetal membranes-Structure and functions in mammals.
- Growth, repair and ageing, amniocentesis.
- Chromosomes, types of chromosome, Human Karyotype and chromosomal abnormalities and syndromes. Hormonal, Chromosomal and Genic balance theory of sex determination. Sex linkage and Sex linked inheritance in Man.
- Blood Groups and their significance, Blood bank.
- Tissue culture, Genetic engineering (Brief idea). Mutation, gene mutation.
- Human population-Natality, Mortality, Sex ratio, Population explosion, dynamics Of human life with respect to food supply, housing, health and standard of living impact of population, problems and their control.

### **TAXONOMY EVOLUTION ECONOMIC ZOOLOGY:**

- Classification-Binomial and trinomial nomenclature, Basic features of classification.
- Classification of different animal phyla upto classes with characters and suitable examples.
- ORIGIN OF LIFE. Theories of Organic evolution-Darwin, Lamarck, Synthetic. Evidences of organic evolution. Human evolution.
- Economic Zoology' Sericulture, Apiculture, Lac culture, Poultry, fishery and peral industry.
- Protozoan disease in relation to man. Insect carrying diseases in relation to man.
- Cancer-types of cancer and cancer cell.
- Communicable diseases (Hepatitis, AIDS) STD, Immune Response, Vaccines and antisera, Allergies.
- Smoking, alcoholism and drug addiction, symptoms and control.
- Wild life conservation.
- pesticides-Uses, advantages and hazards.

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