RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS OF COMPETITIVE EXAMINATION FOR THE POST OF SENIOR TEACHER
SECONDARY EDUCATION DEPARTMENT

SCIENCE

PAPER- II

Part-I Secondary and Senior Secondary Standard:

- **Cell and Molecular Biology**: Structure and functions of cell and cell organelles, Nucleic acids; Central dogma; Structure and functions of Proteins, Carbohydrates and Lipids.
- **Genetics:** Mendelian work and Mendelism; Blood groups and Genetic disorders.
- **Taxonomy:** Five Kingdom System; classification and characteristics of major phylum of Animal Kingdom (Invertebrates and Vertebrates) and Lower Plant groups (Algae to Pteridophyte).
- **Ecology and Environmental Biology**: Food chain, food web and ecological pyramids; Pollution (air, water, soil and noise); Wildlife and its conservation; endangered species; Sanctuaries and National parks with special reference to the state of Rajasthan.
- **Biotechnology:** Recombinant DNA technology - Tools and techniques; Genetic Library, Polymerase Chain Reaction.
- **Microbiology:** Viruses, Bacteria, Mycoplasma, Lichens.
- **Plant Morphology and Anatomy**: Types of Plant tissues, Histological organisation of monocot and dicot root, stem and leaves; Structure of flower; Types of inflorescence.
- **Water Relation:** Water as a biomolecule - physical and chemical properties; Osmosis, DPD, Plasmolysis, Water potential, Absorption of water, Ascent of sap.
- **Photosynthesis:** Photosynthetic pigments; Photo systems; Red drop phenomenon; Emmerson effect; Light reaction, Dark reaction (C3 cycle); Bacterial photosynthesis and Chemosynthesis.
- **Enzymes:** Structure, Mechanism of Action and Factors affecting enzyme activities.
- **Plant Growth and Development:** Differentiation, Dedifferentiation and Redifferentiation. Roles of Plant Growth Regulators - Auxin, Gibberellins, Cytokinins, Ethylene and Abscisic acid.
- **Animal Developmental Biology:** Gametogenesis, Fertilization, Cleavage, Gastrulation, Organogenesis.
- **Evolution:** Lamarkism, Darwinism, Natural selection, Concept of species and speciation, Adaptation and Adaptive radiation.

- **Human Anatomy and Physiology:** Structure and function of human tissue, digestive system, excretory system, respiratory system, circulatory system and nervous system.
- **Human Health:** Nutrition, common human diseases, vaccination, immunity, tissue and organ transplantations and Bio- treatment techniques.
- **Biology in Indian Knowledge System**
- **Atomic Structure:** Fundamental Particles, Atomic models and their limitations, dual nature of particles, de-broglie equation, uncertainity principle, Modern concept of atomic structure, quantum numbers, Aufbau principle, Pauli's exclusion principle, Hund's rule, (n+l) rule. Electronic configuration of elements. Atomic mass, molecular mass, Equivalent mass, Mole concept, Symbols, ions, radicals, variable valancies, type of formulas – empirical formula, molecular formula, Chemical stoichiometry.
- **Chemical Bonding and Molecular Structure:** Ionic bond, covalent bond, coordinate bond. General properties of ionic and covalent bond, polarization, hybridization, Geometry of molecules, directional properties of bond, Fajan's Rule, concept of resonance**.**
- **Classification of Elements and Periodicity in Properties:** Mendeleev's periodic law and classification of elements, limitation of Mendeleev's periodic table, Modern concept of periodic table, electronic configuration and nomenclature of elements, Periodicity in properties - atomic and ionic radii, ionisation enthalpy, electron gain enthalpy, electro negativity and valency.
- **Equilibrium:** Law of mass action and its application to homogeneous equilibria, Le-chatelier principle and its application to physical and chemical system. Factors affecting chemical equilibria. Ionic equilibria in solutions, Acid-base concept, pH scale, Buffer solution. Dissociation of acid and base, Common ion effect and its importance. Solubility product and its uses.
- **Redox Reactions:** Concept of redox reactions, Oxidation numbers, balancing and applications of redox reactions.
- **Organic Chemistry:** Different methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compouds. Homolytic and heterolytic bond fission, free radicals, carbocations, carbanions, electrophiles and nucleophiles, type of organic reactions.
- **Hydrocarbons:** Aliphatic hydrocarbons (Alkane, Alkene and Alkyne); Aromatic hydrocarbon (Benzene), concept of aromaticity, chemical properties.
- **Physical World and Measurements**: Fundamental and derived units, systems of units, dimensional formula and dimensional equations, accuracy and error in measurements.
- **Vectors:** Unit vector, vector addition and multiplication.
- **Kinematics:** Motion in one dimension, uniformly accelerated motion, motion with uniform velocity, relative velocity.

- **Laws of Motion:** Newton's laws of motion, impulse, momentum, conservation of momentum.
- **Work, Energy, Power:** Work done by a constant/variable force, kinetic and potential energy, conservative/non-conservative forces, friction, power.
- **Rotational Motion:** Angular momentum, torque, centripetal & centrifugal force, moment of inertia, rolling motion.
- **Gravitation:** Universal laws of gravitation, gravitational acceleration (g), variation of g, orbital velocity, escape velocity, planetary motion, Kepler's law.
- **Properties of Matter:** Hooke's law, Young's modulus, bulk modulus, tortional rigidity, applications of elastic behaviour.
- **Fluid mechanics:** Pascal's Law, types of flow of liquid, critical velocity, coefficient of viscosity, terminal velocity, Stoke's law, Reynold's number, Bernoulli's theorem and applications, surface tension.
- **Electricity and Magnetism:** Current electricity, magnetic effect of current and electromagnetic induction.
- **Ray Optics:** Laws of reflection and refraction, image formation by lenses and mirrors, total internal reflection, dispersion by prism, scattering of light, defects in vision, microscope, telescope.

Part-II Graduation Standard:

- **Cell and Molecular Biology:** Cell cycle, mitosis, meiosis and their significance. Chromatin organisation. DNA replication; Transcription; Translation.
- **Genetics:** Regulation of gene expression in prokaryotes, sex determination and sex linked inheritance, maternal inheritance. Mutations and chromosomal aberrations.
- **Animal Taxonomy:** Classification and characteristics of animal kingdom up to class level.
- **Animal Anatomy and Function:** Locomotion in Invertebrates, nervous system in Invertebrates and Vertebrates. Reproductive system in Invertebrates and Vertebrates. Circulatory system in Invertebrates and Vertebrates.
- **Taxonomy of Angiosperms:** Bentham & Hooker system of Angiosperms Classification: Economic importance, Characteristic features, Floral formula and Floral diagram of families - Euphorbiaceae, Solanaceae, Malvaceae, Convolvulaceae, Fabaceae, Asteraceae and Poaceae.
- **Ecology and Environmental Biology:** Structure and functions of ecosystem; Ecological succession; Energy flow; Biogeochemical cycles – Carbon, Nitrogen, Oxygen, Phosphorus; Major biomes of the world. Red Data Book. Major environmental issues - Global warming, Greenhouse effect, Acid rain, El-Nino and La-nina, Ozone depletion, Deforestation, Carbon emission, Radiation hazards.

- **Biotechnology:** Gene transfer techniques; plant and animal tissue culture; Application of biotechnology in agriculture and medicine; Transgenic animals and plants.
- **Cryptogams:** General characteristics, Reproduction and Types of life cycles of Algae, Fungi, Bryophytes and Pteridophytes.
- **Seed Plants:** Evolution of seed habit. Classification, General characteristics and Reproduction in Gymnosperms.
- **Plant Anatomy:** Plant Meristems, secondary growth in dicot and monocot stem and root.
- **Reproduction in Plants**: Double fertilization, types of embryos and endosperms, polyembryony, apomixes, parthenocarpy.
- **Water Relations:** Transpiration, Guttation, factors affecting transpiration, mechanism of phloem transport.
- **Respiration:** Respiration: Types of respiration; Glycolysis, Kreb cycle; Respiratory quotient; Fermentation.
- **Plant Growth and Development**: Kinetics of growth, photoperiodism, vernalisation, seed dormancy, senescence, biological clock.
- **Animal Developmental Biology:** Extra embroyonic membranes, placenta, regeneration, stem cells, teratology, animal cloning, test tube baby, fate maps, parthenogenesis, aging, paedogenesis and neoteny.
- **Human Physiology:** Endocrine system, digestive glands, nerve impulse conduction, muscles contraction, hormonal control of reproduction, gas transport of oxygen and carbon dioxide in blood, cardiac cycle, blood clotting.
- **Economic Zoology:** Economic importance of Protozoa, Annelids, Insects and Mollusca; Social life of honey-bee and monkeys.
- **Co-ordination Compounds:** Co-ordination number, Ligands and their types and Werner's theory, IUPAC nomenclature of co-ordination compounds and formulation of mono nuclear co-ordination compound, Isomerism, shapes, colors, magnetic properties in complexes, stability of co-ordination compounds, metal carbonyl compound (classification, preparation, bonding and properties).
- **Molecular Structure:** Elementary idea about Valence Bond Theory, Molecular Orbital Theory (for simple homo-nuclear diatomic molecules), Valence Shell Electrons Pair Repulsion Theory, Crystal Field Theory.
- **States of Matter: Gaseous state-** gas laws, ideal gas equation, Dalton's law of partial pressure, kinetic theory of gases, deviation from ideal behavior, critical temperature and its importance, liquification of gases. **Liquid state**- properties of liquid, vapoure pressure, surface tension and viscosity coefficient and its application. **Solid state-** classification of solids, crystal structure.

- **Zero group elements:** Position in periodic table, isolation, compounds of zero group elements.

  s and p -block elements: Electronic configuration, general characteristics and properties.

  d-block elements: Electronic configuration, general characteristics for e.g. color, oxidation state, tendency to form complexes, magnetic properties, interstitial compound, catalytic properties, alloys.

  f-block elements: Lanthanides and Actinides, Electronic configuration, Lanthanide contraction and its consequences, Super heavy elements.
- **Metals and Metallurgy:** Minerals and ores, General principles of metallurgy, Metallurgy of Cu, Fe, Al and Zn.

  Non-metals and their Compounds: Carbon, Nitrogen, Sulphur, Oxygen, Phosphorous, halogens, Allotropes of C, S and P and their uses. Cement and Plaster of Paris.
- **Chemical Kinetics**: Order and molecularity of reactions, first and second order reactions and their rate expressions (no derivation), Zero and Pseudo order reactions, Arrhenius equation, Collision theory and Activated Complex Theory.
- **Solutions:** Osmotic pressure, lowering of vapour pressure, depression of freezing point and elevation of boiling point. Determination of molecular weight in solution. Association and dissociation of solutes.
- **Electrochemistry:** Electrochemical cells, electrode potentials, measurement of e.m.f. Conductance: Cell constant, specific and equivalent conductivity, Kohlrausch's Law and its applications, solubility and solubility product, equivalent conductivity at infinite dilution of weak electrolytes, hydrolysis and hydrolysis constant.
- **Surface Chemistry**: Adsorption, homogenous and heterogeneous catalysis, colloids and suspensions.
- **Reaction Mechanism:** Inductive, Mesomeric and Hyper-conjugation, Addition and substitution, Electrophilic addition and substitution reaction, Nucleophilic addition and substitution reactions (SN1 and SN2), Elimination reactions. Directive influence of functional group.
- **Spectroscopy Techniques:** UV-Visible (Lambert-Beer’s law, Auxochrome and Chromophore, various shifts, calculation of λ_{max} values of dienes, polyenes and enone compounds). IR (Molecular vibrations, Hook’s law, intensity and position of IR bands, finger print region, characteristic absorption of common functional groups).

- **Bio-Inorganic Chemistry:** Role of bulk and trace metal ions in biological system with special reference to Mg, Ca, Fe and Cu.
- **Bio-molecules:** Carbohydrates, Proteins, Vitamins, Nucleic Acids.
- **Polymers:** Natural and synthetic polymers.
- **Chemistry in Everyday Life:** Chemical in medicines, Chemicals in food, cleansing agents.
- **Chemistry in Indian knowledge system:** Contribution of Indian chemists
- **Mechanics:** Conservation laws, centre of mass, elastic and inelastic collision, damped and forced oscillations, special theory of relativity
- **Classical Electrodynamics:** Coulamb's law, electric field and potential, dipole, dielectrics, Gauss's theorem and application, capacitance alternating current Maxwell's equations.
- **Wave Optics:** Huygen's principle, interference of light, diffraction of light, resolving power of an optical instrument, polarization and scattering of light.
- **Thermal and Statistical Physics:** Laws of thermodynamics, Carnot's engine and efficiency; internal energy, entropy, enthalpy and Gibb's free energy, kinetic theory of gases, statistical description of system of particles: ensemble, basic postulates, density of states.
- **Quantum Mechanics:** Wave- particle duality, postulates of quantum mechanics, uncertainty principle, linear vector spaces and operators, Schrodinger equation, harmonic oscillator, one dimensional wells and barriers.
- **Atomic and Nuclear Physics:** Radioactivity, alpha, beta and gamma decays, nuclear forces, liquid drop model, fusion and fission, structure of atom, elementary spectroscopy.
- **Electronics:** Network theorems, semiconductor diodes and their applications, BJT and their applications, logic gates and Boolean algebra.

Part-III Teaching Methods:

- Definition and concept of science, nature of science, types of correlation in context of relationship with other school subjects, aims and objectives of science teaching, Scientific method, Scientific literacy, Scientific attitude.
- Principles of developing science curriculum at secondary level, factors affecting the selection and organisation of science curriculum, National Curriculum Framework – School Education 2023 with reference to Science, Unit plan and lesson plan, Taxonomy of educational objectives.
- Methods and approaches – Lecture cum demonstration method, laboratory method, problem solving method, project method, heuristic method, inductive

and deductive method, inquiry approach, constructivist approach, audio-visual teaching aids.

- Science laboratory and its importance, Co-curricular activities- science-club, science quiz, science fair and field trip.
- Evaluation- Concept, type and purposes, preparation of blue print, types of test items, Communicating test results for reflection.

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For the competitive examination for the post of **Senior Teacher:-**

1. The question paper will carry maximum **300 marks**.
2. Duration of question paper will be **Two Hours Thirty Minutes**.
3. The question paper will carry **150 questions** of multiple choices.
4. Negative marking shall be applicable in the evaluation of answers. For every wrong answer one third of the marks prescribed for that particular question shall be deducted.
5. Paper shall include following subjects:-
   (i) Knowledge of Secondary and Senior Secondary Standard about relevant subject matter.
   (ii) Knowledge of Graduation Standard about relevant subject matter.
   (iii) Teaching Methods of relevant subject.

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