TAMIL NADU PUBLIC SERVICE COMMISSION

COMBINED SYLLABUS

PHYSICS /CHEMISTRY / BIOLOGY [BOTANY & ZOOLOGY]

(HSC STANDARD)

A) PHYSICS Code:415

UNIT-I – BASIC PHYSICS

Measurement of fundamental quantities – Length, mass and time – Measurement - Errors -Dimensional formula Introduction - Scalar and Vector – Examples - Newton's laws – Application – Impulse – Friction - Static and Kinetic friction - Centripetal and Centrifugal force – explanation.

UNIT-II – KINEMATICS

Work, Power and Energy – Collision - Elastic and Inelastic collision - Torque and Angular momentum - Couple – Principle of moments - Centre of gravity - Radius of gyration - Rotational motion - Slipping and skidding.

UNIT-III GRAVITATION

Planetary Motion – Kepler's laws - Universal law of gravitation – Gravitational constant - Gravitational field - Acceleration due to gravity - variation of 'g' with height, depth and latitude - Escape velocity - Orbital velocity, Interesting astronomical facts - Recent development in Astronomy.

UNIT-IV: PROPERTIES OF MATTER

Elastic properties of materials - Stress and strain - Hooke's law - Moduli of elasticity - Poisson's ratio Elastic energy - Applications of elastic Properties – Fluids - Pressure of fluid - Pascal's law and applications – Buoyancy - Viscosity – Stream line and turbulent motion - Reynold number - Terminal Velocity - Stoke's law - Applications of viscosity - Surface tension – Factors affecting surface Tension- Angle of contact – Bernoulli's theorem and applications.

UNIT-V: HEAT AND THERMODYNAMICS

Thermal properties of matter – Expansion of solids, liquids and gases - Anomalous expansion of water - Change of state – Calorimetry - Newton's law of cooling - Laws of heat transfer - Thermal equilibrium – Internal energy - Laws of thermodynamics – (Zeroth, first and second laws) – Entropy.

UNIT-VI: WAVES AND OSCILLATIONS

Mechanical wave motion and its types - Velocity of transverse and longitudinal waves in different media - Factors affecting speed of sound in gases - Reflection of sound waves – Interference – Introduction – Beats - Loudness and Intensity - Vibration of air Column and Doppler effect - Periodic and Non Periodic Motion – Types of oscillations.

UNIT-VII ELECTRICITY AND MAGNETISM

Charges - Properties of charges - Coloumb's law – Electric field – Explanation - Electrostatics of conductors and insulators - Electrostatic shielding - Electrostatic induction - Dielectrics or Insulators - Capacitors – Applications – Effect of dielectric in capacitors - Action of points - Lightning arrestor -Vandegraff generator - Current electricity - Introduction - Ohm's law - Specific resistance or resistivity - Carbon resistor - Temperature co-efficient of resistance - Heating effect of electric current - Joule effect - Seebeck effect - Peltier effect and Thomson effect - Magnetic field - Elements of magnetic field - Magnetic properties - Types of magnetic materials – Hysteresis - Eddy current and applications.

UNIT-VIII: ELECTRO MAGNETIC WAVES AND OPTICS:

Introduction of electro magnetic waves - Properties of electro magnetic waves - Electro magnetic spectrum – Types of spectrum – explanation.

RAY OPTICS AND WAVE OPTICS

Reflection – Images formed by plane mirror- spherical mirror - Images formed by spherical mirror- Lateral Magnification - Refraction – Apparent depth – Total internal reflection – Fibre Optics –Explanation Thin lenses – lateral magnification in thin lenses - Focal length of lenses in contact - Silvered lenses - Dispersive power - Scattering of sun light - Wave nature of light - Interference in white light (polychromatic light) - Interference in thin films – Diffraction - Optical instruments –Simple microscope - Compound microscope - Astronomical telescope – Spectrometer - Human eye - Near sighted and far sightedness – Astigmation - Photo electric cell - Applications - Wave nature of particles - De Broglie Wave length - De Broglie Wave length of electrons - X-ray spectra – Continuous and Characteristics X-ray Spectra – Applications.

UNIT-IX: ATOMIC AND NUCLEAR PHYSICS

Introduction – Atomic spectra – Nucleus - Isotopes, isotones and isobars - Nuclear Mass, Atomic mass and Nuclear density - Radioactivity - Alpha, Beta and Gamma decay - Radio carbon dating - Nuclear fission and fusion.

UNIT-X: ELECTRONICS AND COMMUNICATION SYSTEM

Classification of materials - Types of semiconductors - Diodes and types - Digital electronics - Integrated chips – Elements of electronic communication systems - Propagation of electromagnetic waves - Important communication systems - Nano science and technology - Robotics and applications - Physics in Medical diagnosis and therapy.

B) CHEMISTRY

UNIT-I: BASIC CONCEPTS OF CHEMISTRY AND CHEMICAL CALCULATIONS

Mole Concept - Gram Equivalent Concept - Empirical Formula and Molecular Formula – Stoichiometry - Redox Reactions - Expressing concentration of solutions.

Quantum Mechanical Model of Atom

Introduction to atom models - Wave particle duality of matter - Heisenberg's uncertainty principle - Main features of the quantum mechanical model of atom - Energies of orbitals - Filling of orbitals

Periodic Trends in Properties

UNIT-II: THERMODYNAMICS

Zeroth law, First Law - Enthalpy (H), Thermochemical Equations, Hess's law of constant heat summation, Lattice energy, Second Law - Gibbs free energy (G), Third law.

UNIT-III: EQUILIBRIUM

Chemical - Dynamic nature, Homogeneous and heterogeneous equilibria - Law of mass action, Application of equilibrium constant - Le-Chatelier's Principle.

Ionic - Arrhenius Concept, Lowry–Bronsted Theory (Proton Theory), Lewis concept - Ionisation of water - The pH scale - Ostwald's dilution law - Buffer Solution - Buffer action - Henderson – Hasselbalch equation - Solubility Product.

UNIT-IV: CHEMICAL BONDING

Types of chemical bonds – Covalent bond - Ionic or electrovalent bond - Coordinate covalent bond - Bond parameters - Valence Shell Electron Pair Repulsion (VSEPR) theory - Valence Bond Theory – Hybridisation - Molecular orbital theory.

UNIT-V: METALLURGY AND TYPES OF ELEMENTS

Mineral and ore - Concentration of ores - Extraction of crude metal - Refining process - Applications of metals.

s-block: General characteristics of alkali and alkaline earth metals - Important compounds - Sodium Carbonate, Sodium hydroxide, Calcium Oxide, Calcium Hydroxide, Gypsum and Plaster of Paris.

p-block: Borax - Boric acid - Allotropes of carbon **–** Silcones - Ammonia **-** Allotropic forms of phosphorus - Phosphine - Sulphur dioxide - Sulphuric acid - Chlorine - Inter halogen compounds - Uses of noble gases.

d-block elements: General trend in properties - Important compounds of Transition elements - Potassium dichromate, Potassium permanganate

f-block elements: Lanthanoids – position in periodic table, Electronic configuration, Oxidation state, Atomic and ionic radii, Causes and consequences of lanthanoid contraction, Actinoids-Electronic configuration, Oxidation state, Atomic and ionic radii

UNIT-VI: COORDINATION COMPOUNDS

Werner's theory, Definition of important terms, Nomenclature, Isomerism in coordination compounds, Valence Bond Theory.

UNIT-VII: SOLID STATE

Classification of solids - Crystalline solids Amorphous solids - Classification of crystalline solids - Ionic solids, Covalent solids, Molecular solids, Metallic solids - Crystal lattice and unit cell - Number of atoms in a cubic unit cell (sc, bcc, fcc) - Packing efficiency (sc, bcc, fcc) - Schottky defect, Frenkel defect, Metal excess defect, Metal deficiency defect.

UNIT-VIII: CHEMICAL KINETICS

Rate law and rate constant – Molecularity - The integrated rate equation (zero and first order) - Half life period of a reaction - Arrhenius equation – The effect of temperature on reaction rate - Factors affecting the reaction rate - Nature and state of the reactant, Concentration of the reactant, Surface area of the reactant, Temperature of the reaction, Presence of a catalyst.

UNIT-IX: ELECTRO CHEMISTRY

Conductivity of electrolytic solution – Resistivity, Conductivity - Molar conductivity - Equivalent conductance - Factors affecting electrolytic conductance - Variation of molar conductivity with concentration - Kohlraush's law - Electrochemical Cell - Thermodynamics of cell reactions - Nernst equation - Electrolytic cell and electrolysis - Faraday's Laws of electrolysis - First Law and Second Law.

UNIT-X: ORGANIC CHEMISTRY

Alcohols - IUPAC nomenclature, Preparation, Properties, Uses - Methods to differentiate primary, secondary and tertiary alcohols - Phenols – Preparation, Properties, Uses.
Ethers:- IUPAC nomenclature, Preparation, Properties, Uses.
Aldehydes, ketones and carboxylic Acids - IUPAC nomenclature, Preparation, Properties, Uses.
Organic Nitrogen Compounds - Nitro compounds, amines and diazonium salts - IUPAC nomenclature, Preparation, Properties, Uses.

C) BIOLOGY

I. BOTANY

UNIT –I: TAXONOMY OF ANGIOSPERMS

Taxonomy and systematics – Taxonomic Hierarchy –Concept of species – Morphological, Biological and Phylogenetic – ICBN (Internation code of Botanical Nomenclature) – Binomial Nomenclature – Types of classification (Bentham and Hooker –natural) Engler and Prantil – phylogenetic] APG classification – Herbarium and its uses- Selected Families [Fabaceae, Solanaceae , Lilliaceae].

UNIT –II: PLANT ANATOMY

Tissue and Tissue Systems (Meristematic and Permanent tissues) Meristematic – Characteristics and Classification – Permanent [simple tissues and complex tissues]- Tissue system – Types [Epidermal, Ground and Vascular tissue] – Anatomy – Primary Structure of Dicot and Monocot Root stem, leaf – Secondary Growth of Dicot stem [vascular cambium, Bark]-Secondary Growth of Dicot Root.

UNIT –III: CELL BIOLOGY AND GENETICS

Plant and animal cell- Prokaryote and Eukaryotes – Protoplasm – Cellwall – Cell organelles- Chromosome structure and types – Special types of chromosomes – Cell Cycle – mitosis and meiosis- Mendalism -

[Monohybrid dihybrid cross Test cross and Back cross – Incomplete dominance- Chromosomal Theory of Inheritance- Linkage and Crossing Over – Mechanism of Crossing over – Recombination – Genetic mapping – Ploidy – Nuclic acids – DNA, RNA (Types and Structure) Replication of DNA.

UNIT –IV: BIOTECHNOLOGY, PLANT BREEDING AND ECONOMICALLY USEFUL PLANTS

Development of biotechnology – Methods of Biotechnology- Single cell protein (SCP) –recombinant DNA Technology – Molecular techniques – Isolation of Genetic meterial and gel electroprosis – Nuclic Acid Hybridization and blotting techniques – Genome Sequencing – Genome and CRISPR – cas9 – Transgenetic Plants (Bt crops) – Biopiracy - Plant tissue culture (PTC)-Protoplasmic fusion- Organic Agriculture – Bio Fertilizers –Plant breeding Methods – Modern Plant breeding –Food Plants – Spices and Condiments – Timber, Fibers , Latex,Pulpwood, Dyes – Cosmetics – Traditional system medicines –Medicinal Plants.

UNIT –V: PLANT PHYSIOLOGY

Types of transport – Cell to Cell transport – Plant water relation – Absorption of water – Ascent of Sap – Transpiration – Translocation organic solutes – Mineral absorption- Photosynthesis – significance – site of Photosynthesis –Photosynthetic pigments, spectrum of Electromagnetic Radiation - Photosynthetic unit, Absorption and action spectrum– Cyclic and non- Cyclic photophosphorylation – C3 and C4 - Photorespiration – CAM – factors affecting- Photosynthesis – Photosynthesis in bacteria – respiration –Glycolysis – Kerb's cycle- Pentose Phosphate Pathway, Eletron Transport chain – Anaerobic respiration- respiratory quotient – Fermentation- plant Growth – Characterestics of growth, Growth Regulators- [auxins –Giberellins –Cytokinins – Ethylene and abscisic acid] –Photo Periodism and Vernalization Senescence.

II. ZOOLOGY

UNIT–VI: HUMAN PHYSIOLOGY

Nutrition and Digestion:

Introduction – Nutrients – Vitamins – Mineral Salts – Water – Caloric Values of Carbohydrates – Proteins and Fats – Nutritional and digestive disorders – Digestive system – Digestion of Food and role of digestive enzymes – Absorption and assimilation of proteins, carbohydrates and Fats – Egestion-Tissue Level of Organisation- Animal Tissues-Epithelial Tissues-Connective Tissues- Muscle Tissues- Neural Tissues.

Respiration:

Respiratory function – Respiratory Organs in various organisms mechanism of breathing – Exchange of gases – Transport of gases – Regulation of respiration – Problems in oxygen transport – Disorders of respiratory system – Effects of smoking.

Body fluids and circulation:

Body fluids – Blood vessels – Arteries, Veins, Capillaries – circulating pathway – Human circulating system double circulation – Regulation of cardiac activity – Disorders of the circulating system – Diagnosis and Treatment.

Excretion:

Modes of excretion – Human excretory system – Mechanism of Urine formation in human – Regulation of Kidney function – Micturition – Role of other organs in Excretion – Disorders related to the excretory system – Haemodialysis.

Locomotion and moments:

Types of movements – Muscles – Skeletal muscle structure of contractile protein – Mechanism of muscle contraction – Types of skeletal muscle contraction – properties of skeletal muscle – skeletal system and its functions – The axial skeleton – The appendicular skeleton – Types of Joints – Disorders of muscle and skeletal system – Benefits of regular exercise – Bone Fracture – Dislocation of Joints and treatment – Physiotherapy.

Neural control and coordination:

Neural system – Human Neural System – Neuron as a structural and functional unit of neural system – Central neural system – Reflex action and reflex arc – Sensory reception and processing.

Chemical coordination and Integration:

Endocrine glands and hormones – Human endocrine system – Hypo and hyper activity of endocrine glands and related disorders – Mechanism of hormone action.

Reproduction in organisms:

Modes of reproductions – Asexual reproduction – sexual reproduction – Human reproductive system – Gametogenesis – menstrual cycle – Menstrual disorders and menstrual hygiene – Fertilization and Implantation – Maintenance of Pregnancy and embryonic development, Parturition and lactation – Reproductive Health – Amniocentesis – Population explosion and birth control – Medical termination of pregnancy – Sexually transmitted disease (STD) – Infertility – ART – Detections of Foetal disorders during early pregnancy.

UNIT–VII: HUMAN HEALTH AND DISEASES AND MICROBES IN HUMAN WELFARE

Common diseases in human beings – Maintenance of personal and public hygiene – Adolence – Drug and alcohol abuse – Mental health – Depression – Life style disorders in human beings – Microbes in Household products – Microbes in industrial products – Microbes in sewage treatments and energy generation – Microbes in Production of biogas – Bio-remediation.

UNIT–VIII: BASIC MEDICAL INSTRUMENTS AND TECHNIQUES

Diagnostics and Monitoring instruments – Imaging instruments – Therapeutic instruments – Biomedical techniques – Application of Bio technology – Applications in medicine – gene therapy – Stem cell therapy – Molecular Diagnostics – Transgenic Animals Biological products and their uses – Animal Cloning – Ethical issues – Regulation in bio technology – possible threats of genetically modified organism – Bio-safety guidelines.

UNIT–IX: PRINCIPLES OF GENETICS INHERITANCES AND VARIATION

Multiple alleles – Genetic control of Rh factor – Sex determination – Sex linked inheritance – Karyo typing – Pedigree analysis – Mendelian disorders chromosomal abnormalities – Extra Chromosomal inheritance – Eugnics / Euphenics – Euthenics.

Molecular Genetics:

Gene as the functional unit of inheritances – in search of the genetic material chemistry of nucleic acid – Basic concepts of Transcription and Translation – genetic code – t-RNA – the adapter molecule – Human Genome Project (HGP) DNA Finger printing technique - Application of DNA finger printing.

UNIT–X: ENVIRONMENTAL BIOLOGY, LIVING WORLD EVOLUTION AND IMMUNOLOGY

Organism and its environment – Habitat – Major abiotic components of factors – Concept of Biome and their distribution – Population interaction. Bio-diversity and its conservation – Bio-diversity – Importance of bio diversity – Bio geographical regions of India – Threats and causes of Biodiversity loss – IUCN (The International Union for Conservation of Nature) – National Parks in Tamil Nadu – Wildlife sanctuaries in Tamil Nadu – Gene banks – Bio-Diversity Act (BDA).

Environmental issues:

Pollutions – Pollutants Air, Water, Noise pollutions – Agrochemicals – Bio magnification Eutrophication – Organic farming and its implementation – Solid waste management – Ecosan Toilets

The Living World:

Diversity in the living world – Need for classification – Taxonomy and Systematics – Three domains of life – Taxonomy Hierarchy – Nomenclature – Concepts of species – Tools for study of taxonomy – Kingdom Animalia – Basics of classification – classification of kingdom Animalia – phylia – Inverebrates – Phylumchordata

Evolution and Immunology:

Origin of life – evolution of life forms – geological time scale – Biological evolution and evidences – Theories of Biological evolution – Origin and evolution of man – Isolative mechanism – Speciation – Extinction of animals – Immunology Basic concepts of Immunology – Innate, acquired Immunity – Lymphoid organs – Antigen Antibodies – Vaccine - Immuno deficiency diseases.

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