Syllabus for Graduate Primary School Teachers for Classes 6 to 8

Paper II
MATHEMATICS

- **Number Sysyem** - Place value, Expanded form, Basic operation, Simplification, Natural, whole, integer, rational, irrational and real numbers, Square and cubic numbers, Square and cube roots, Playing with numbers, HCF, LCM, fundamental theorem of arithmetic, Ratio and Proportion, Comparing Quantities.

- **Surds -** Definition, Basic operation, Simplification, Binomial surds, Rationalisation of surds.

- **Sets -** Properties, Types, Laws, Venn diagram, Cardinality of sets, Relations and functions.

- **Progressions -** Sequence and series, AP, GP and HP, Means.

- **Commercial Mathematics -** Unitary method, Percentage, Profit and loss, Brokerage, Commission, Simple interest, Compound interest, Discount, Hire purchase and instalment buying.

- **Statistics**
  Class interval and types, Graphical representation, Measurement of central tendency, Dispersion measures, Co - efficient of variation.

- **Permutation and Combination -** Meaning, Formulae, Fundamental counting principle, Factorial notation

- **Probability -** Meaning, Types- Random experiments and events, Types of events, Addition rule.

- **Basic Concepts of Algebra -** Basic terms, Algebraic expressions, Types of polynomials, Basic operations, Special products, Factorisation, Identities, Conditional identities, HCF and LCM.

- **Polynomials -** Meaning and types, Zeros of polynomials, Division algorithm, Remainder factor theorem, Synthetic division theorem.

- **Linear Equations -** Linear equations, Simultaneous linear equations, Different methods of solving.

- **Exponents -** Laws, Problems

- **Quadratic Equations -** Meaning and types, Different methods of solving, Descriminant, Sum and product of roots, Formation of quadratic equation.

- **Variation -** Meaning ant types, Problem based on variation.

- **Basic Geometrical Ideas -** Basic definitions, Axioms, Postulates, Statements, Theorems

- **Triangles -** Meaning, Types, Properties, Construction, Area and perimeter, Heron's Formula, Congruent and similar triangles, Concurrent lines (*centroid, in centre, circumcentre and ortho centre*)

- **Quadrilaterals -** Meaning, Types, Properties, Construction, Area and Perimeter, Theorems

- **Polygons -** Meaning, Types, properties, Theorems, Constructions, Problems

- **Circles -** Definition, Terms and their meaning, Cyclic quadrilaterals, Chords and tangents, Theorems, Constructions, Area of sector.

- **Mensuration -** Plane figures, Solid figures, LSA and TSA of solid figures, Volume of solid figures(*cone, sphere, cylinder, frustum of cone, prisms, pyramids and combination of solids*).

- **Trigonometry -** Basic ratios, Identities, Standard angles, Complementary angles, Heights and distances, Problems, Allied angles.

- **Co ordinate Geometry -** Ordered pair, Distance formula ,Section formula, Slope, Equation of straight line, Slope intercept form.

- **Symmetry -** Definition, Line of symmetry, Point of symmetry.

- **Matrices -** Definitions, Types, Determinants.

- **Polyhedra and Networks -** Meaning and type, $F+v=E+2$, Nodes, area and regions, Euler Formula, Transversable networking and conditions for transvesability

PHYSICS

- **Measurement, Units and dimensions:** Fundamental and derived units, fundamental forces in nature, Measurement of longer distance objects like sun, planets etc, measurement of very small distances like size of atom , errors , types of errors, significant figures.
- **Magnetism:** Magnetic field, properties of magnet, Biot-savart's law, Ampere's circuital law-applications, magnetic lines of force-properties. Solenoid , toroid, Cyclotron – applications, Force on current carrying conductors, Magnetic materials- types and examples. Electromagnets , factors affecting their strength, permanent magnets.
- **Current Electricity:** Electric current, Drift velocity, mobility, Ohm's law, electrical resistance, resistivity, conductivity, electrical power. Carbon resistors , colour codes of carbon resistors, series and parallel combi9nation of resistors. Cell- Internal resistance, potential difference, emf , series and parallel combination. Kirchhoff's laws. Wheat stone bride, potentiometer, meter bridge principle and applications.
- **Dynamics:** Scalars and vectors meaning and examples, Displacement, Distance travelled, speed, velocity, acceleration units and problems. Newton's three laws of motion and illustrations. Inertia, Force, work, momentum units and problems. Circular motion-centripetal force, centrifugal reaction and applications. Position and displacement vectors, resolution of vectors, scalar and vector product of vectors. Friction , laws of friction, types of friction, factors affecting friction, methods of increasing and reducing friction. Centre of mass, momentum of force, torque, angular momentum. Equilibrium of rigid bodies, rotational motion, moment of inertia.
- **Gravitation & Rockets and artificial satellites :** Meaning, acceleration due to gravity, variation of acceleration due to gravity on the earth. Newton's law of gravitation, Weight, weightlessness. Principle, fuel, payload, Different stages, Launching of rockets. Escape velocity, orbital velocity, communication satellites, geo-stationary satellites. ISRO-programs, moon mission, MOM.
- **Thermodynamics.** Heat and temperature meaning and differences. Different scales of measurement of temperature and inter conversions. Laws of thermodynamics, Isothermal and adiabatic process, reversible and irreversible process. Heat engines- different types, petrol and diesel engine, efficiency of heat engine- problems, refrigerators –principle and working
- **Optics:** Properties of light,. Mirrors , different types of mirrors and image formation, mirror formula, uses. Lenses , image formation in different types of lenses at different object position, power of lens Uses. Refraction and dispersion of light through prism .Phenomenon and laws of reflection and refraction. Dispersion of light, scattering of light, total internal reflection, optical fibres –uses. Theories of light- Newton's corpuscular theory, Huygen's wave theory, Maxwell's electromagnetic wave theory, Max planck's quantum theory, dual nature of light. Raman effect, optical instruments : simple and compound microscope, telescope, binoculars - magnifying powers. Polarisation –plane polarised light, polaroids and their uses, Application in daily life
- **Electromagnetic radiation:** Meaning, examples, properties, uses of different electromagnetic radiations. Photo electric effect, experimental facts about pef, Einstein/s explanation and applications of Pef. Electromagnetic spectrum, Laser meaning , production, properties and uses.
- **Energy :** Meaning different forms of energy, law of conservation of energy . Inter conversion of energy from one form to another form. Power, Kinetic energy and potential energy meaning , example and problems.
- **Electronics and communication system:** Conductors, insulators and semiconductors meaning and examples. Energy bands in solids, Bias and types. Doping, dopants. p/n junction diode, transistor, LED, Photodiode, Solar cell, Zener diode, Construction of simple circuits, series and parallel combination of cells and bulbs. circuit symbols of components of circuits. Superconductors, Fuse. Logic gates(AND, OR,NOT,NOR,NAND). Radio broadcasting-receiver and transmitter, television broadcasting – transmitter and receiver, modulation, band width of transmission medium, propagation of electromagnetic waves in space. Telephone, Fax, Mobile, internet working and applications.

- **Oscillations and waves:** Periodic motion –period, frequency, displacement. Simple harmonic motion - k.e and p.e, free, forced and damped oscillations, resonance. Wave motion, Transverse and longitudinal waves,, Speed of wave motion. Sound waves, Echo's. Wavelength, period, frequency, amplitude of waves. Superposition of waves, reflection of waves, standing waves in strings and pipes, fundamental mode and harmonics , beats, Doppler effect.
- **Modern physics:** Atom, constituents of atom and their properties. Atomic no, mass no, nuclear chain reaction, Nuclear fission , nuclear fusion and applications. Meaning , elements possess radioactivity, α-decay. β –decay and ɤ-decay. Half-life and mean life period, problems. Isotopes, Isotones, Isobars with ex. Atomic models – Rutherfold's model, Bohr's model, Thomson model. Mass energy relation, mass defect, binding energy- problems.
- **Universe :** Horizon, Geocentric system, solar centric system, Constellations, Zodiac constellations. Moon, different phases of moon. Formation of eclipses. Solar system, facts about sun, planets and their satellites, asteroids, comets. Galaxy, types of galaxy, stars, life cycle of different mass stars, Quasars, Pulsars, Stellar luminosity, temp of stars. Hubble's law, big bang theory. Kepler laws of planetary motion
- **Friction :** Meaning, types, causes, factors affecting friction, methods of increasing and reducing friction, uses and effects of friction.

    Sound: Sound waves, Echo's. Wavelength, period, frequency, amplitude of waves. Infrasonic and ultrasonic sound waves. Sonar, ultra sound scanner, their uses.

CHEMISTRY

- **Basic concepts of chemistry:** Molarity, molality, numerical problems, mole fraction, mass percentage
- **Structure of an atom:** Dalton's theory – Fundamental particles and properties – electronic configuration – Bohr's theory of hydrogen atom – Rutherford's theory – J.J.Thomson experiment – Goldstains Alpha particle experiment – valency – valence electrons- Atomic number – Element symbol – Atomic mass – Atomic Mass Unit – Molecular mass – Avogadro number – Mole Concept – Isotopes. Quantum numbers – Aufbau's principle – Hunds rule – Pauli's Exclusion Principle – Percentage Composition – Shape of s, p, and d orbitals - empherical formula. De Broglie Relationship, numerical problems, Heisenberg uncertainty principle
- **Classification of elements:** Dobariner's Triads – Newlands Octave's – Mendeleev's – Modern periodic table. Periodic trends of Modern periodic table. Transition elements and inner transition elements- properties
- **Chemical bonds:** Ionic bond – Covalent bond – Hydrogen bond – Metallic bond – Electron Sea Model – Ionic compounds – Covalent Compounds: Nature and properties– Co-ordination bond –, polar and non polar compounds – sigma bond – pi bond – Hybrid orbitals: SP, SP2 and SP3, VSEPR theory- examples CH_4, H_2O, NH_3, VBT orbital overlap concept-ss, s p,p p with examples, Hybridization Sp3d with pcl5
- **Molecular orbital theory**: salient features, formation of molecular orbital by LCAO method
- **Electronic configuration and molecular behavior**- bond order, nature of bond, bond length.
- **Matter:** States of matter – Element – compound – mixtures – solutions – Anomalous expansion of water – Boyle's law and Charles law - applications. Boyle's law, Charles' law- its numerical problems. Gay Lussac's law
- **Metallurgy :** Metals and non-metals, Physical and Chemical Properties of Metals and Non-metals, Uses of metals and Non-metals, Alloys, Corrosion
- **Chemical Reactions:** Meaning and types of chemical reactions – Chemical combination, decomposition, displacement, double displacement – oxidation – reduction – catalysts.–

exothermic and endothermic reactions – reducing agent – oxidizing agent, Equilibrium in chemical process-Le Chatelier's principle, (factors affecting equilibrium) Ionic equilibrium

- **Acids, bases and salts:** Meanings – examples – properties – uses: strong – weak – dilute acids – concentrated acids – hydrated salts – efflorescent – deliquescent. Theories of acids and bases with examples. Ionization of acids and bases, degree of disassociation, Ionic product of water
- **Organic chemistry:** Carbon and its compounds – allotropes of carbon – catenation – isomerism – Hydrocarbons: Aliphatic and Aromatics – Aromatic hydrocarbons properties and uses – petrochemicals – fractional distillation of petroleum - combustion of hydrocarbon fuels – calorific value – octane number – thermal cracking – Functional groups – Manufacture of sucrose. Poly functional group, Hydrogenation, Ethyl alcohol preparation
- **Chemical properties:** Substitution reaction, halogenations, combustion, controlled oxidation (catalytic oxidation) pyrolysis, Markownikoff's rule
- **Test for unsaturated hydrocarbons:** Aromatic hydrocarbons-structure of Benzene, resonance and stability of Benzene, electrophilic substitution reaction- Halogenations, Nitration, Sulfonation, Friedel craft's alkylation
- **Solid state :** Crystal lattice, FCC, bcc and cubic
- **Solutions:** Colloids and its properties, Raoult's law, colligative properties
- **Electro chemistry:** Factors affecting the products of electrolysis. Leclanche cell, lead acid battery H_2-O_2 fuel cell.
- **Chemical kinetics:** Rate of Reaction- factors affecting rate of reaction, first order and half life, pseudo first order reaction, Temperature –Arrhenius equation, activation energy, energy distribution curve.
- **d-block elements**: electronic configuration of 3d series elements , general trends in properties of first row transition metals, metallic character, oxidation state, magnetic properties , colour, catalytic properties, alloy formation.
- **Chemicals in our daily life:** Soaps – detergents – cement – glass – ceramics – washing soda – baking powder – plaster of Paris - paper – Pharmaceuticals – Bleaching powder – Fertilizers: Raw materials and uses, Chemicals in medicines-antacids, antibiotics disinfectants, antiseptics and analgesics.

BIOLOGY

- **Living World**: Characteristics of Living Organisms: Plants, Animals and microbes.
- **Life processes in plants**: Transpiration, osmosis, diffusion, active transport, translocation of food and water, mechanism of opening and closing of stomata; theories, guttation, heories of water transportation, Trophic movements-photo, geo, thigmo, hydro. Photosynthesis-Factors affecting photosynthesis., Light and Dark reaction, Respiration (Aerobic and anaerobic), Factors affecting respiration, Cellular respiration steps (Glycolosis and Krebs cycle), Growth. Growth curve, Growth hormones, Factors affecting Growth, Experiments on plants growth.   Reproduction (Vegetative, Asexual and sexual in detail.) Parthenocarpy in plants.
- **Reaching the age of adolescence:** Changes at Puberty, Role of hormones in initiating reproductive function, Sex determination, types of hormones
- **Life process in animals:** Movement, Respiration, Circulation (heart. blood. blood vessels), Digestion (in detail), Excretion (in detail), Control and co-ordination(Glands-exocrine and endocrine). Sense organs in human beings-in detail
- **Natural resources:** Meaning, Types, Classification, Importance of soil(types), forest(forest ecosystem, diversity in forest),fossil fuels(different types),water, minerals and conservation.
- **Food:** Meaning, importance, Nutrients. Components of food-types, functions, examples. Simple tests for Carbohydrates, fats and lipids   Concept of balanced diet, deficiency diseases – Why do we fall ill? – Health and hygiene, diseases and their causes, types of diseases - infectious and non-infectious, prevention of diseases, Immunisation., Adulteration of food-

Meaning, causes, effects, Tests to find out some common adulteration of food (Act regarding adulteration).

- **Ecology:** Components (biotic, abiotic), biomes-types. Interaction between biotic and abiotic factors.
- **Soil erosion:** Meaning, causes, effects, soil conservation methods.
- **Pollution**: meaning, types (Air, Water. soil, Sound, radioactive), causes, effects, controlling measures.
- **Water**: Importance, management, rain water harvesting, conservation.
- **Green house effect**: Meaning, importance, green house gases, Global warming-causes, effects.
- **Eco system:** Components, trophic levels, food chain, food web, Ecological pyramids, importance. Biological fixation of nutrients.
- **Cytology:** Plant cell and animal cell-Differences, Cell organelles, functions, Cell division (mitosis and meiosis)
- **Classification of organisms:** 2,3,4,5 kingdom classification., Detailed study of monera, protista, Mycota, Plantae & animalia. , Hirerchy of clasification and examples.
- **Micro Organisms** Types (Virus, Bacteria, Fungus, Protozoans), Beneficial and harmful micro organisms, Examples (Common diseases caused by them).
- **Evolution:** Theories (Theory of natural selection, Use and dis use theory), Darwinism, Neo Darwinism. Evidences of evolution like - Fossil, homologues, analogues, embryological.

Human Evolution. (complete study)

- **Plant kingdom**: Algae, Fungi, Bryophyta, Pteridophyta, gymnosperms, and Angiosperms Ecological importance.
- **Tissues (Plants and Animals) in detail:** Meaning, Types, Function of tissues .
- **Genetics: Heredity**- Mendel's laws of Inheritance, Mono hybrid and Di-hybrid cross, test cross, In complete dominance, Co-dominance, D.N.A. Double helix model,
- **Tissue culture** - process, applications. Genetically modified organisms (plants and animals), Transgenic animals.
- **Bio Technology:** Principles, Application in Agriculture, Medicine, - Cloning, DNA fingerprint technology, tissue culture, genetic engineering, recombinant DNA technology, tests-elisa, PCR,western blot, harmful effects and ethical issues.
- **Animal resources:** Sericulture (In detail), Dairy (In detail), Poultry (In detail), Vermiculture (In detail), pisiculture, (in detail), apiculture.

Exam Structure

Section 1 – Multiple Choice Questions

Marks – 50

Duration – 1 hour

Section 2 - Short and Long answer type questions

Marks – 100

Duration – 2 hours