Ramakrishna Mission Vidyapith

P.O. – Vivekananda Nagar, Dist. – Purulia, West Bengal - 723147
(A Branch Centre of Ramakrishna Mission, Belur Math, Howrah, West Bengal – 711202)
Phone: 9609535336, 6297283340 ; Email: rkmvpurulia@gmail.com ; Web: www.rkmvpurulia.in

RECRUITMENT OF ASSISTANT TEACHERS AND NON-TEACHING STAFF (GOVT.) - 2021

UPPER PRIMARY SECTION
SUBJECT : PURE SCIENCE
SYLLABUS

MATHEMATICS

I. ALGEBRA

A. Classical Algebra:

1. Complex number: Definition on the basis of ordered pairs of real numbers. Algebra of complex numbers, modulus amplitude, conjugate, Argand diagram. Demovire's Theorem and its applications. Exponential, Sine, Cosine and Logarithm of a complex number. Definition of az(a 0). Inverse Circular and Hyperbolic functions.
2. Polynomial, Synthetic division. Remainder theorem: Fundamental theorem of Classical Algebra (statement only). Polynomials with real coefficients; the nth degree polynomial equation has exactly n roots. Nature of roots of an equation (surd or complex roots occur in pairs). Statement of Descrte's Rule of signs and its applications. General properties of equations. Multiple roots. Rolle's theorem and its application Relation between roots and co-efficeints, symmetric functions of roots. Transformation of equations. Cardan's method of solution of a cubic.
3. Determinants upto the third order. Definition of a determinant, Properties, Minors and cofactors. Product of two determinants. Adjoint, Symmetric, and Skew-symmetric determinants. Solutions of linear equations with not more than three variables by Cramer's Rule 4. Matrices of Real Numbers: Definition, Equality of matrices. Addition of matrices, Multiplication of a matrix by a scalar. Multiplication of matrices. Scaler matrix, identity matrix. Inverse of a non-singular square matrix. Elementary operations on matrices, Rank of a matrix; determination of rank either by considering minors or by Sweepout process. Consistency and solution of a system of linear equations with not more than three variables by matrix method.

B. Modern Algebra:

1. Basic concepts: Sets, Subsets, Equality sets, Operations on Sets. Union Intersection and Complement. Verification of the laws of algebra of set and De Morgan's Laws. Cartesian product of two sets. Mappings One to one and onto mapping composition of mappings Identity and inverse mappings.
2. Introduction to Group Theory. Group Definition and examples taken from different branches (examples from number system, roots of unity 2 x 2 real matrices, non-singular real matrices of fixed order). Elementary properties using definition of group. Definition and example of subgroup.
3. Definitions and examples of Ring. Field, Sub-ring, Sub-field.

4. Concept of Vector Space over a field: Examples, Concepts of linear combinations Linear dependence and independence of finite set of finite set of vectors. Subspace, concepts of Generators and Basis of a finite dimensional vector space.
5. Real quadratic form involving not more than three variables – Problem only.
6. Characteristic equation of square Matrix of order not more than three. Determination of Eigen values and Eigen vectors – Problems only. Statement and illustration of Cayley – Hamilton theorem.

II. GEOMETRY

A. ANALYTICAL GEOMETRY OF TWO DIMENSIONS.

1. Transformation of Rectangular axes.
   Translation, Rotation and their combinations. Invariants.
2. General Equation of second degree in x and y. Reduction to canonical formsclassification of Conic.
3. Pair of straight lines: Condition that the general equation of second degree in x and y may represent two straight lines. Point of intersection of two intersecting straight lines. Angle between two lines given by $ax^2 + 2hxy + by^2 = 0$. Equation of Bisectors. Equation of two lines joining the origin to the points which a line meets a conic.
4. Equation of pair of tangents from an external point, chord of contact, poles and polars of ellipse and hyperbola.
5. Polar equations of straight lines and circles, polar equation of conic referred to a focus a pole. Equation of chord joining two points. Equations oftengents and normals.

B. ANALYTICAL GEOMETRY OF THREE DIMENSIONS:

1. Rectangular Cartesian co-ordinate. Distance between two points. Division of a line segment in a given ratio. Direction cosines and Direction ratios of a straight line. Projection of a line segment on another straight line. Angle between two straight lines.
2. Equation of a plane: General Form, Intercept and Normal Form. Angle between two planes. Signed distance of a point from a plane. Bisectors of angles between two intersection planes.
3. Equation of straight lines. General and symmetric form.Distance of a point from a line. Co planarity of two straight lines. Shortest distancebetween two skew-lines.

III. DIFFERENTIAL CALCULUS

1. Rational numbers Geometrical representation. Irrational numbers. Real numbers represented as points on a line – Linear continuum. Acquaintance with basic properties of real numbers (No deduction of Proof is included).
2. Sequence: Definition of bounds of a sequence and Monotone sequence. Limit of a sequence. Statement of theorems. Concept of convergence and divergence of monotone sequences – applications of the theorems, in particular, definition of e. Statement of Cauchy's general principle of convergence and its applications.
3. Infinite series of constant terms. Convergence and divergence (definitions). Cauchy's principle as

applied to Infinite series (application only). Series of positive terms. Statements of comparison test, D'Alembert's Ratio test. Cauchy's root test Applications Alternating series: Statement of Leibnitz test and its applications.

4. Real valued functions defined on an interval: Limit of a function (Cauchy's definition). Algebra of limits. Continuity of a function at a point and in an interval. Acquaintances (no proof) with the important properties of continuous functions on closed intervals. Statement on existence of inverse function on a strictly monotone function and its continuity.
5. Derivative. Its geometrical and physical interpretation. Sign of derivative – Monotonic increasing and decreasing functions. Relation between continuity and derivability. Differential application in finding approximatuer. Successive derivative Leibnitz's theorem and its application.
6. Statement of Rolle's Theorem and its geometrical interpretation. Mean value Theorems of Langranceand indeterminate Forms. L. Hospital's Rules Application of the Principle of Maximum and Minimum for a function of single variables in geometrical physical and other problems.
7. Functions of two variables. Their geometrical representations. Limit and continuity (definitions only) for functions of two variables partial derivatives. Knowledge and use of chair rule. Differentiation of implicit functions of two variables (existence being assumed). Function of two variable successive partial derivatives Statement of Schwarz's Theorem on commutative property of mixed derivatives. Statement of Euler's Theorem on homogeneous function of two variables. Maxima and minima of functions of two variables.
8. Applications of Differential calculus: Tangent and normal. Envelope of family of curves (problems only)

IV. INTERGRAL CALCULUS

1. Integrations of the form –
   $\int \frac{dx}{a+bcosx}$, $\int \frac{(1sinx+mcosx)dx}{nsinx+pcosx}$
   and integration of rational functions.
2. Evaluation of definite Integrals.
3. Integration as the Limit of a sum (with equally spaced intervals).
4. Reduction formula of
   $\int sin^m x cos^n x\, dx, \int \frac{sin^m x}{sin^n x} dx, \int tan^n x\, dx$
   and associated probles (m and n are non-negative integers)
5. Working knowledge of Double Integral.
6. Rectification. Quadrature, volume and surface areas of solids formed by revolution of plane curves and areas.

V.DIFFERENTIAL EQUATION

1. Order, degree and solution of an ordinary differential equation (ODE) in presence of arbitrary constants. Formation of ODE, First order equations.
   (i) Variables separable.
   (ii) Homogeneous equations and equations reducible to homogeneous

forms.

(iii) Euler's and Bermoulli's Equations (Linear)

(iv) Clairaut's Equation: General and Singular solutions.

2. Second order linear equations: Second order linear differential equations with constant coefficients. Euler's Homogeneous equations.

V. VECTOR ALGEBRA

Definition of vector and scalar. Addition of vectors. Multiplication of vector by a scalar. Collinear and coplanar vectors, Scalar and vector products of two and three vectors. Simple applications to problems of Geometry.

VI. ANALYTICAL DYNAMICS

1. Velocity and Acceleration of a particle. Expressions for velocity and acceleration in rectangular Cartesian and polar coordinates for a particle moving in a plane. Tangential and Normal components of velocity and acceleration of a particle moving along a plane curve.
2. Concept of Force: Statement and explanation of Newton's laws of motion. Work, power and energy - Principles of conservation of Energy and Momentum. Motion under impulsive forces. Equations of motion of a particle moving in a straight line.
3. Study of motion of a particle in a straight line order (i) constant forces (ii) variable forces (SHM, Inverse square law. Forced and Damped oscillation. Motion in an elastic string) Equation of energy. Conservative forces.
4. Motion in tow dimensions: Projectiles in vacuo and in a medium with resistance varying linearly with velocity. Motion under forces varying as distance from a fixed point.
5. Central orbit.

VII. LINEAR PROGRAMMING

Motivation of Linear Programming problem. Statements of L.P.P. Formulation of L.P.P. L.P.P. in matrix forms. Convex Set, Hyper plane, Extreme points. Convex Poly hedron. Basic solutions and Basic Feasible solutions (B.F.S.) The set of all feasible solutions of an L.P.P. in a convex set. The objective Function of an L.P.P. assumes its optimal value at an extreme point of the convex set of feasible solutions. Fundamental Theorem of L.P.P. (Statement only) Reduction of a feasible solution to a B. F.S. Standard form of an L.P.P. Solution by graphical method (for two variables) by simplex method (not more than four variables). Feasibility and optimality condition. Method of penalty concept of duality. Duality Theory. The dual of the dual is the primal. Relation between the objective values of dual and the primal problems. Dual problems with almost one unrestricted. Variable, one constraint of equality. Transportation and Assignment problem and their optimal solutions.

VIII. NUMERICAL METHODS

1. Approximate numbers, significant figures, rounding-off numbers. Error : - absolute, relative and percentage.
2. Operator D, N and E (Definition and some relations among them).
3. Interpolations: – The problem of interpolation, Simple problems regarding difference table, Newton's forward and backward interpolation formula.
4. Numerical Integration: Simple problems using trapezoidal and Simpon's 1/3 rule.
5. Solution of Equations: Location of root (tabular method).Bisection Method, Newton-Raphson Method - Numerical problems.

IX. ELEMENTS OF PROBABILITY THEORY AND STATISTICS

1. Introduction: Variables, Statistics, Population & sample. Discrete and continuous variables. Frequency distributions.
2. Measure of Central tendencies: A.M. Medina, Mode.
3. Measures of Dispersions: Range, mean deviation, Standard deviation, variance.
4. Elements of Probability Theory: Concept of sample spaces. Event and random variables. Classical definition of Probability. Total probability, compound probability, conditional Probability. Bayes theorem.

PHYSICS

MECHANICS AND GENERAL PROPERTIES OF MATTER

Rest and motion, reference frame, displacement, velocity and acceleration, momentum, kinematical equations in one, two and three dimensions, elementary problems.

Review of elementary vector algebra, Newton's laws of motion; inertia, units of force, impulse and impulsive forces; conservation of linear momentum; elastic collision of particles moving in the same line; static and kinetic friction; co-efficient of friction.

Definition of work, relevant units. Mechanical energy, Kinetic and potential, conservation of energy, the case of a freely falling body. Power-definitions, units.

Newton's law of universal gravitation on (Statement and mathematical relation), constant of gravitation (definition and value with units, no experimental determination) Definitions of the terms stress, strain elastic limit, Hooke's law, moduli of elasticity.

Archimedes principal, statement Transmission of fluid pressure, pascals law, principle of multiplication of force.

Viscosity: Definition units, dimension, Poiseulle's equation for flow of liquid in narrow tubes, streamline and turbulent motions, critical velocity, Stoke's law for highly viscous liquids.

Surface Tension: Definition, Surface tension and surface energy. Capillary rise of liquid through a capillary tube of insufficient length.

HEAT

Nature of heat and temperature, Thermal expansion of solids and liquids. Co-efficient of linear, superficial and cubical expansion of solids; t1 apparent expansion of liquids; relation between

expansion co-efficient. Boyle's law. Equation of state of an ideal gas; volume and pressure co-efficient; Absolute scale of temperature. Heat as a form of energy, relation between calorie and erg; specific heats of gases (elementary ideas). Heat engine, Carnot cycle efficiency, power generation.

Definition and explanation of the terms; conduction, convection and radiation of heat.

LIGHT

Reflection on plane and curved surfaces, Laws of reflection, definition of real and virtual images, definition of centre of curvature, pole, principal axis, principal focus, focal length of a curved surface.

Refraction of light, laws of refraction definition of refractive index (relative and absolute); total internal reflection, critical angle, relationship between refractive index and critical angle. Formation of mirages.

Convex and concave lenses - Different cases of image formation for both types of lenses.

Basic definition - principal axis, principal foci, power of lenses. Convex lens as a magnifying glass. Dispersion of light, pure and impure spectra - definition only Interference: Definition, sustained interference, Newton's ring,

Diffraction: Definition, Fresnel & Fraunhofer class of diffraction. Difference between Fresnel & Fraunhofer class of diffraction.

SOUND

Simple harmonic motion, periodic motion, time period, frequency, amplitude and phase (definition only) Free vibrations-longitudinal and transverse. Characteristics of progressive waves, wavelength, amplitude of wave, time period, frequency, velocity of wave and their relation. Laws of reflection and refraction of sound waves, formation of echo, Characteristics of standing or stationery wave and comparison with progressive wave.
Vibration of air column in a tube closed at one end open at both ends. Beats - simple explanation.

MAGNETISM, ELECTROSTATICS, CURRENT ELECTRICITY

Permanent and temporary magnet - Explanations only. Definition-magnetic meridian, magnetic field, magnetic intensity. Magnetic lines of force.
Definitions only - Magnetic permeability and susceptibility, dia, para and ferromagnetic substance.
Definition: Declination, Dip and Horizontal component of earth's magnetic field; their explanation.
Coulomb's law of force between two point charges, permittivity, electrostatic unit of charge, electric intensity. Potential difference between two points; e.s.u. of potential, practical unit of potential.
Development of e.m.f. in the cell, defects of cell, Ohm's law, volt, ampere and ohm; resistance, resistivity, factors on which resistance of a conductor depends, combination of resistances in series and parallel. Equivalent resistance. Kirchoff's laws.
Joule's law, Mechanical equivalent of heat (Definition)
Electrical energy, power unit of power and energy, Board of trade unit of electrical energy.
Thermo-electricity, Seebeck and pelitier effect, thermoe.m.f. Thermo current, thermo couple.
Faraday's laws of electrolysis, chemical and electrochemical equivalents.
Ampere's swimming rule, right hand rule, Maxwell's cork-screw rule, Fleming's left hand rule, Fundamental motor rule, Fleming's right hand rule, construction of galvanometer, ammeter and

voltmeter, Magnetic induction, Magnetic flux, flux density, Faraday's law of induction, Lenz's law of induction. Definition of rms and mean value of A.C. voltage and current.

MODERN PHYSICS

Induction of electricity through gases, Cathode ray and their principal properties, X-rays properties, nature of X-rays use X-rays.
Photo electric phenomena. Compton effect.
Bohr's Model of atom; fundamental postulates (deduction of Bohr's formula is not required) de Broglie and Planck hypothesis.
Fundamental constituent of atom. Principal constituents of nucleus; atomic number, isotopes. Mass number.
N-type and P-type semiconductor. Diode as rectifier. Zener diode.
Transistor, amplifier, oscillator, communication principal, modulation and demodulation, optical communication and fiber optics.
Radio-active decay law-statement only. Half-life and decay constant. Radio-isotopes-artificial transmutation of elements with simple illustration. Nuclear fission-mention of their importance and uses.

CHEMISTRY

Unit-1: Atomic Structure, Radioactivity, Nuclear Chemistry and Chemical Periodicity

A. Bohr Model of atom. Bohr's theory (including simple mathematical treatment for hydrogen atom); Sommerfeld model (simple idea); Quantum numbers and their significance, Pauli Exclusion Principle, energy order of orbitals, electronic configuration of atoms; nature & shapes of s & p orbitals (qualitative treatment

B. Nuclear Chemistry – Natural radioactivity, nuclear radioactivity, nuclear stability (neutron-proton) ratio, binding energy); Law of radioactive disintegration, times for fractional disintegrations. The Uranium series, group displacement law, Isotopes, Isobars, Isotones. Elementary idea of nuclear reactions (details not required) artificial radioactivity, fission and fusion reactions (simple examples), separation of isotopes (principles of diffusion & thermal methods) and their uses in medicine and agriculture, radio carbon dating.

C. Periodic classification of elements of the basis of electronic configuration. Major periodic properties. Atomic & ionic radii. Ionization potential, electron affinity & elector negativity (qualitative treatment only) and their variation in respect of s- and p-block elements.

Unit-2: Gaseous State of Matter, Ideal and Non-Ideal Solutions, Phase Equalibria and Colloids.

A. The gaseous state, Laws of partial pressure & volumes; Graham's law of diffusion; Kinetic theory of gases; mean, r.m.s. and the most probable velocities, ideal gas laws from kinetic theory; Kinetic energies of gas molecules, specific heats of gases. Dumas' and Victor Meyer's method for determination of vapour densities; limiting densities, abnormal vapourdenisities. Real gases, Amagat's Curves, Andrew's curves, Andrew's isothermals, the critical state, van der Waal's equation, its application at the critical state.

B. The colligative properties of dilute solution. Osmosis, osmotic pressure, lowering of vapour pressure, elevation of boiling point &depression of freezing point-experimental determination, relevant laws, their applications & conditions of validity; abnormal colligative effects.

C. Conductance of electrolytic solution - its experimental determination. Specific, equivalent &

molar conductances, their variation with concentration; conductance at infinite dilution. Kohlrausch's law. Ion conductance. Ionic mobility; transport number, determination by Hittorf's method. Application of conductance measurement; determination of ionization constants of weak electrolytes, solubility of sparingly soluble salts, Conduct metric titrations.

D. The phase equilibria - The phase rule (derivation not required); phase diagrams of one component systems; water &sulphur; Applications of phase rule; Henry's law, Nernst distribution law; distillation behaviour of completely miscible binary liquid mixtures.

E. The colloidal state- Classification (dispersion, association & macromolecular colloids); preparation purification & stability (lyophobic & lyophilic); peptisation& coagulation; properties – physical, colligative, optical, kinetic & electrical. Protective colloids, gold number, isoelectric point.

Unit-3: Chemical Thermodynamics, Chemical Kinetics and Their Applications, Acid-Base and Redox Equilibria

A. Thermodynamic systems & surroundings, the properties of variables of state, the internal energy & the enthalpy. First law, reversible & irreversible processes, the maximum work, the thermodynamic criteria of ideal gases, P-V-T relationship of ideal gas under isothermal & adiabatic conditions, Joule Thomson effect. Thermo chemistry: Heats of reaction at constant pressure & constant volume; thermo chemical equations in terms of enthalpy changes, the standard heats of combustion, formation & transition; Heat of solution; Hess's Law. The Carnot cycle, second law of thermodynamics, elementary idea of entropy; Helmholtz free energy & Gibb's free energy; their relevance in respect of spontaneity or otherwise of physico chemical processes.

B. Chemical equilibrium: law of mass action, Kp& Kc; Le-Chatelier& Braun's principle of mobile equilibrium; simple illustrations of homogeneous chemical equalibria, variation of equilibrium constant with temperature; van't Hoff equation (derivation not required).

C. Ionic equilibria, water as an ionizing solvent, ionic product of water, pH of aqueous solutions, measurement of pH, (hydrogen electrode &colourmaching methods); Acid-Base theory: Bronsted- Lowry concept, Lewis concept, Molecular structural effects on acid-base properties. Ostwald's dilution law; solubility product & its applications, common ion effect. Salt hydrolysis, buffer solutions and their pH. Acid-base indicators.

D. Electromotive force; reversible & irreversible electrodes –chemical cells; standard cells; measurement of e.m.f.; Electrode potentials, type of electrodes; standard electrode potentials (std. hydrogen electrode), their significance; E.M.F. series; Nernst equations for electrode potential (with derivation, Reference electrodes.

E. Chemical Kinetics –molecularity &order of reactions, rate equations; experimental determination of rate constants, chain reactions & photochemical reactions (simple illustrations only), Catalysis: its criteria, simple illustrations of homogeneous & heterogeneous catalysis, auto &iduced catalysis; catalyst poisons, catalyst promoters; enzyme catalysis.

Unit -4: Chemical Bonding and Structure

A. Chemical bonds – ionic, convalent (polar, non polar) type and nature of bond of carbon with $H_20_2N_2$ halogen and carbon; co-ordinate bond, hydrogen-bonding and its effect on physical properties, intermolecular forces, hybrid orbials (involving s & p orbitals) of carbon & its stereochemistry; optical and geometrical isomerism (ene unsaturation & two asymmetric centres). Structure of simple binary molecules: AX_1, AX_2, AX_3, AX_4 (relating to [s & p] hybrid orbitals only);

bond polarity, simple ideas of electro negativity, dipoe moment, metallic bond.

B. Qualitative ideas of inductive, resonance &electromeric effects, hyper conjugation, simple ideas of mechanisms of electrophilic &nucleophilic substitutions (definition with examples); condensation, free radical, polymerization, and addition reactions.

C. Double & complex salts; perfect & imperfect complexes. Werner theory of coordination, isomerism for coordination number 4 and 6. IUPAC nomenclature of co-ordination compounds (mononuclear complexes only), chelate complexes and their applications in chemical analysis.

Unit- 5: Chemistry of Elements & their Compounds (1)

A. Noble Gases: Occurrence & isolation of noble gases (from liquid air - no technical detail required); uses of noble gases; Xenon fluorides; preparations, properties & uses.

B. Study of the elements & their compounds (as mentioned below with regard to their preparation, properties bonding and uses unless otherwise mentioned).

(i) Boron and Aluminium: Boron trifluoride & trichloride; borazine, boron nitride; boron trioxide, NaBH4, boric acid &borax, Al_2O_3, $AlCl_3$, $LiALH_4$, alum.

(ii) Carbon, Silicon Germanium, Tin & Lead: General comparative study of carbon & silicon with respect to their normal hydrides, halides, oxides & oxy acids, Silicon carbide; Sodium silicate; Silicate; Silicic acid, Silcagel, Hydrofluosilicic acid, Silicon tetrafluoride and tetrachloride, Calcium carbide.

(iii) Nitrogen, Phosphorus, Arsenic, Antimony and Bismuth: Comparative study of the elements and their compounds (like normal hydrides, halides, oxides and oxyacids) Hydroxylamine, Hydrazine and Hydrazoic acid, Sodium bismuthate.

(iv) Oxygen, Sulphur, Selenium &Telelurium: Comparative study of the elements and their compounds (hydrides, halides, oxides and oxyacids, sodium thiosulphate; Peroxymono- and Peroxydi-sulphuric acids, selenium dioxide. Deuterium and its oxide, hydrogen peroxide, ozone.

(v) Halogens: Comparative study of Fluorine, Chlorine, Bromine and Iodine with respect to their reactivity. Hydracids and their properties; Oxides and oxyacids of chlorine, perchloric acid, interhalogens, pseduohalogens and ployhalides.

Unit – 6: Chemistry of Elements & Their Compounds (2)

A. Metals: Occurrence: principles of extraction , purification and uses of the following metals (with emphasis on the Indian context); Li, Ag, Au, Sn, Pb, Cr, Mn, Co, Ni, Hg. Chemistry of the important compounds of these metals. General characteristics of the first row transition metals. Comparative study: Li-Na-K, Be-Mg-Ca-Si-Ba, Cr-Mn-Fe, Co-Ni-Fe, Co-Ni-Fe, Co-Ni, Cu-Ag-Au, Zn-Cd-Hg.

B. Redox Reactions: Ion-electron method of balancing equations: Equivalent weight of oxidants and reductans: Chemical problems involving oxidimetry and reductimetry (in relation to the estimation of common metal ions: Fe, Cu, Mon, Cn).

Unit - 7: Chemistry of Carbon Compounds (1)

A. Petrolium as the industrial sources of aliphatic hydrocarbons. General methods of preparation, properties & reactions of alkanes upto five carbon atoms; Alkensupto four carbon. Cis-trans isomerism; Alkadienes; Butadiene, Isoprene; Akynesupto four Carbon atoms. Mechanism of chlorination of methane, bromination of ethylene, Markownikoff s rule,

haloalkanes, haloform reaction Detection and estimation of C, H and N in organic compounds.

B. Monohydric alcohols upto four carbon atoms. Dihydiric alcohol: ethylene glycon; Trihydric alcohol: glycerol, Mechanism of dehydration of ethanol to ethylene; ethers;

C. Aliphatic aldehydes and ketones upto four carbon atoms. Mechanism of bas-catalysed aldol condensation of acetaldehyde.

D. Synthesis and important reactions of aliphatic monobasic carboxylic acids, Acid chlorides, Acid anyhydrides, esters, amides, nitriles. Dicarboxylc acids-Oxalic acid, malonic acid; Hydroxy acids-Lactic acid, Malic acid, Trataric acid.

Unit - 8: Chemistry of Carbon Compounds (2)

A. General Methods of preparation, properties and reactions of Primary, Secondary and Tertiary amines upto four carbon atoms; Quaternary ammounium salts, micelles (examples and uses).

B. Preparation and Synthetic uses of (i) Grignard reagents, (ii) Ethyl acetoacetate and (iii) Diethyl malonate.

C. Classification of carbohydrates; preparation, properties, reactions of glucose and fructose; Conversion of glucose to fructose and vice versa, Constitution of glucose and fructose including pyranose structure, Haworth's structure, Disaccharides, inversion of sucrose.

Unit - 9: Chemistry of Carbon Compounds (3)

A. General Methods of preparation, properties and reactions of Benzene, Toluene, Xylene; modern strusctural idea of benzene; Orientation, Aromaticity; Friedel Craft's reaction and its mechanism.

B. Aromatic nitro compounds, Nitrobenzene, 0-, m- and p- Nitroanlines, Aromatic diazo compounds: Benzene diazonium salts, Pheny-hydrazene; Benzene sulfonic acid.

C. Aromatic hydroxyl compounds Phenol, Picric acid: Benzyl Alcohol; Aromatic aldehydes and ketones - Benzaldehyde, Salicylaldehyde, Benzophenone, Acetophenone.

D. Aromatic carboxylic acids and their derivaties - Benzoic acid, Salicylic acid, Phyenyl acetic acid, Cinnamic acid, Phthalilc acid, Benzoyl chloride, Behzoice anhydride, Ethyle benzoate, Methylsalicylate, Acetysalicylic acid, Benzamide, Benzonirile; Mechanism of Cannizzaro reaction of Benzaldehyde.

E. Idea of structural formula (only) of the following compounds: Pyrrole, Furan, Thiophene, Pyridine and Quinoline.

Unit - 10: Application Oriented Chemistry

A. Chemical Analyses: Principles & Applications.

Gravimetric and titrimetric (acid-base, redox and complexometric EDTA) estimation of common cations and anions. Analysis of complex materials: ores, alloys, water and air samples, inorganic and organic samples, drugs and pharmaceuticals. Error analysis.

B. Chemistry in Industry. Production and technical uses of stainless steels, alloy steels, non-ferrous alloy and amalgams. Chemistry of electroplating, anodizing. Galvartizing and photography. Solid, liquid and gaseous fuels, coal based chemicals and petrochemicals (C_1 to C_3compounds). Glass and ceramic materials, Port-land cement (composition and setting). Chemical fertilizers and biofertilizers. Polymers: Polythene, P.V.C., natural and synthetic rubbers, synthetic

fibres: Nylon-66, polyesters. Biopolymers and biodegradable polymers.

C. Technical materials:

Drugs,pharmaceuticalsand fermentation chemicals: preparationlextraction/isolation/purification and uses of aspirin, paracetamol enovid, sulfadiazine, quinine, chloroquine, vitamin C. Phenobarbital, metronidazole, chlorpromazine; ethyl alcohol, citric acid, lactic acid, Vitamin B_{12}, penicillin. Constituents and formulations of paints and varnishes, oil-base paints, latex paints and backed-on paints (alkyl resins). Synthetic dyes: methyl orange, congo red, Malachite green, crystal violet, indogo, alizarin, anline yellow.

D. Domestic & Useful Materials:

Fats-oils-detergents, edible and inedible oils of vegetable origin, hydrogenation of unsaturated oils, production of vanaspati and margarine, toilet soaps and washing soaps; Cosmatics and perfumes; Hair dyes, creams suntun lotions, face poweder, talcum powder, tooth powder, tooth paste, shampoos: uses of geraniol, jasmine, civetone amylactate. Pesticides and food additives: Production applications and residual toxicity of gamaxene, DDT, aldrin, parathion, malathion, paraquat, decamethrin. Food flavours, food colours and preservatives, artificial sweetners, acidulants and alkalies, edible emulsifers and foaming agents, sequesterants (uses and abuses of).

E. Environmental Chemistry:

Environmental segments: atmosphere, hydrosphere, lithosphere and biosphere. Environmental cycles: hydrologic cycle, carbon-oxygen-, nitrogen-, phosphorus-, and sulfur cycles. Composition and structure of the atmosphere, Ozone layer and its importance, air pollutants and their sources, air pollution control measures. Environmental role of water, major water pollutants, water quality parameters, water treatment (domestic, industrial and waste water)