MP-PET Syllabus

MATHEMATICS

I : ALGEBRA

Unit 1	Sets,Relations and Functions	Sets and their Representations, Union, intersection and complements of sets and the algebraic properties, Relations, equivalence relations, mappings, one-one, into and onto mappings, composition of mappings.
Unit 2	Complex Numbers	Complex number in the form a+ib and their representation in a plane. Argand diagram. Algebra of complex numbers, Modulus and Arguments (or amplitude) of a complex number, square root of a complex number. Cube roots of unity, triangle-inequality.
Unit 3	Matrices and Determinants	Determinants and matrices of order two and three, properties of determinants. Evaluation of determinants. Area of triangles using determinants, Addition and multiplication of matrices, adjoint and inverse of matrix. Test of consistency and solution of simultaneous linear equations using determinants and matrices.
Unit 4	Quadratic Equations	Quadratic equation in real and complex number system and their solutions. Relation between roots and co-efficients, nature of roots, formation of quadratic equations with given roots; Symmetric functions of roots.
Unit 5	Permutation & Combination	Fundamental principle of counting; Permutation as an arrangement. Meaning of P(n,r) and C(n,r) Simple applications.
Unit 6	Mathematical Induction and its applications	-
Unit 7	Binomial Theorem and its Applications	Binomial Theorem for a positive integral index; general term and middle term; Binomial Theorem for any index. Properties of Binomial Co-efficients. Simple applications for approximations.
Unit 8	Sequences and Series	Arithmetic, Geometric and Harmonic progressions. Special cases of Sn, Sn2, Sn3. Arithmetic-Geometric Series, Exponential Logarithmic series.

II : CALCULUS

Unit 9	Differential Calculus	Polynomials, rational, trigonometric, logarithmic and exponential functions. Inverse functions, Graphs of simple functions, Limits, Continuity; differentiation of the sum, difference, product and quotient of two functions, differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order upto three. Applications of derivative, monotonic functions. Maxima and minima of functions of one variable.
Unit 10	Integral Calculus	Integral as an anti-derivative, Fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions. Integration by substitution, by parts and by partial fractions. Integration using trigonometric identities. Integral as limit of a sum. Properties of definite integrals. Evaluation of indefinite integrals; Determining areas of the regions bounded by simple curves.
Unit 11	Differential Equations	Ordinary differential equations, their order and degree. Solution of differential equations by the method of separation of variables. Solution of homogeneous and linear differential equations.

III : TWO AND THREE DIMENSIONAL GEOMETRY

Unit 12	Two dimensional Geometry	Recall of Cartesian system of Rectangular co-ordinates in a plane, distance formula, area of a triangle, condition for the collinearity of three

		points and section formula, centroid and in-centre of a triangle. Locus and its equation, translation of axes, slope of a line; parallel and perpendicular lines. Intercepts of a line on the coordinate axes.
Unit 12	The straight line and pair of straight lines	Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrency of three lines, distance of point from a line, coordinates of orthocentre and circumcentre of triangle, equation of family of lines passing through the point of intersection of two lines homogeneous equation of second degree in x and y, angle between pair of lines through the origin, combined equation of the bisectors of the angles between a pair of lines, condition for the general second degree equation to represent of pair of lines, point of intersection and angle between two lines represented by S=O and the factors of S.
Unit 12	Circles & system of Circles	Standard form of equation of a circle, general form of the equation of a circle its radius and centre, equation of a circle in the parametric form, equations of a circle. When the end points of a diameter are given, points of intersection of a line and a circle with the centre at the origin and condition for a line to be tangent to the circle. Length of the tangent, equation of the tangent, equation of a family of circles through the intersection of two circles, condition for two intersecting circles to be orthogonal.
Unit 12	Conic Section	Sections of cones, equations of conic sections (parabola, ellipse and hyperbola) in standard forms, condition for $y=mx+c$ to be a tangent and point(s) of tangency.
Unit 13	Three dimensional Geometry	Coordinates of the point in space, distance between the points; Section formula, direction ratios and direction cosines, angle between two intersecting lines, equations of a line and plane in different forms; intersection of a line and a plane, coplanar lines, equation of a sphere, its centre and radius. Diameter form of the equation of a sphere.

IV : VECTORS

Unit 14	Vector Algebra	Vector and Scalars, addtion of vectors, components of a vector in two dimensions and three dimensional space, scalar and vector products, vector triple product. Application of vectors to plane geometry.

V : STATISTICS

Unit 15	Measures of Central Tendency and Dispersion	Calculation of Mean, median and mode of grouped and unpgrouped data. Calculation of standard deviation, variance and mean deviation for grouped and ungrouped data.
Unit 16	Probability	Probability of an event, addition and multiplication theorems of probability and their applications; Conditional probability; Probability distribution of a random variable; Binomial distribution and its properties.

VI : TRIGONOMETRY

Unit 17	TRIGONOMETRY	Trigonometrical ratios, identities and equations. Inverse trigonometric function and their properties. Properties of triangles, solution of triangles. Height and Distances.

VII : STATICS AND DYNAMICS

Unit 18	Statics	Resultant of Coplanar forces; moments and couples. Equilibrium of three concurrent forces.
Unit 19	Dynamics	Speed and velocity, average speed, instantaneous speed, acceleration and retardation, resultant of two velocities, relative velocity an its simple applications. Motion of a particle along a line moving with constant

		acceleration. Motion under gravity. Laws of motion, Projectile motion.
	PHYSICS	
Unit 1	Units and Measurement	Units for measurement, system of units-S.I., fundamental and derived units. Dimensions and their applications.
Unit 2	Description of Motion in one dimension	Motion in a straight line, uniform motion, its graphical representation. Uniformly accelerated motion, and its applications.
Unit 3	Description of Motion in Two and Three dimensions	Scalars and vectors, vector addition, multiplication of a vector by a real number, zero-vector and its properties. Resolution of vectors. Scalar and vector products, uniform circular motion and its applications, projectile motion.
Unit 4	Laws of Motion	Force and inertia-Newton's Laws of motion. Conservation of linear momentum, rocket propulsion. Inertial frames of references. Static and kinetic friction, laws of friction, rolling friction.
Unit 5	Work, Energy and Power	Concept of work, energy and power, Energy-kinetic and potential. Conservation of energy. Elastic collisions in one and two dimensions. Different forms of energy.
Unit 6	Rotational Motion and Moment of Inertia	Centre of mass of a two-particle system. Centre of mass of a rigid body, general motion of a rigid body, nature of rotational motion, torque, angular momentum., conservation of angular momentum and its applications. Moment of Inertia and its physical significance, parallel and perpendicular axes theorem, expression of moment of inertia for ring, disc and sphere.
Unit 7	Gravitation	Acceleration due to gravity, one and two-dimensional motion under gravity. Universal law of gravitation, variation in the acceleration due to gravity of the earth. Planetary motion, artificial satellite - geostationary satellite, gravitational potential energy near the surface of earth, gravitational potential and space velocity.
Unit 8	Properties of Matter	Inter-atomic and inter-molecular forces, states of matter (A) Solids : Elastic properties, Hook's law, Young's modulus, bulk modulus, modulus of rigidity. (B) Liquids : Cohesion and adhesion. Surface energy and surface tension. Flow of fluids, Bernoulli's theorem and its applications. Viscosity, Stoke's Law, terminal velocity. (C) Ideal gas laws.
Unit 9	Oscillations	Periodic motion, simple harmonic motion and its equation of motion, energy in S.H.M., Oscillations of a spring and simple pendulum.
Unit 10	Waves	Wave motion, speed of a wave, longitudinal and transverse waves, superposition of waves, progressive and standing waves, vibration of strings and air-columns, beats, resonance. Doppler effect in sound.
Unit 11	Heat and Thermodynamics	Thermal expansion of solids, liquids and gases and their specific heats, relationship between C_r and C_u for gases. First law of thermodynamics, thermodynamic processes. Second law of thermodynamics, carnot cycle, efficiency of heat engines.
Unit 12	Transference of Heat	Modes of transference of heat. Thermal conductivity. Black body radiations, Kirchoff's law, Wien's law, Stefan's law of radiation and Newton's law of cooling.
Unit 13	Electrostatics	Charges and their conservation. Coulomb's law. S.I. unit of charge, dielectric constant, electric field, lines of force. Field due to dipole and its behaviour in a uniform electric field, electric flux, Gauss's law in simple geometries. Electric potential, potential due to a point charge. Conductors and insulations, distribution of charge on conductors. Capacitance, parallel plate capacitor, combination of capacitors, energy of capacitor, Van de Graff generator.

Unit 14	Current Electricity	Current as a rate of flow of charges, sources of energy, cells-primary and secondary, grouping of cells, resistance of different materials, temperature dependence, specific resistance, Ohm's law, Kirchoff's law, series and parallel circuits. Wheatstone Bridge, measurement of voltages and currents, potentiometer.
Unit 15	Thermal and Chemical Effects of Currents	Heating effects of current, electric power, simple concept of thermo electricity - (Seeback effect and its explanation), thermocouple, Chemical effects of current and laws of electrolysis.
Unit 16	Magnetic Effects of Currents	Oersted's experiment, Biot-Savert's law (magnetic field due to a current element), magnetic field due to a straight wire, circular loop and solenoid, force on a moving charge in a uniform magnetic field (Lorentz force), forces and torques on currents in a magnetic field, force between two current carrying wires, moving coil galvanometer, ammeter and voltmeter.
Unit 17	Magnetostatics	Bar magnet, magnetic field, lines of force, torque on a bar magnet in a magnetic field, earth's magnetic field, tangent galvanometer, vibration magnetometer, para, dia and ferro-magnetism, magnetic induction, magnetic susceptibility.
Unit 18	Electromagnetic Induction and Alternating Currents	Induced e.m.f., Farady's Law, Lenz's Law, self and mutual induction, alternating currents, impedance and reactance, power in a.c. circuits, LCR series combination, resonant circuits. Transformer, simple motor, and A.C. generator.
Unit 19	Ray Optics	Sources of light, luminous intensity, luminous flux, illuminance and photometry (elementary idea). Reflection and refraction of light at plane and curved surfaces, total internal reflection, optical fibre, deviation and dispersion of light by a prism; Lens formula, magnification and resloving power; microscope and telescope.
Unit 20	Wave Optics	Wave nature of light; Interference ? Young's double slit experiment. Diffraction ? diffraction due to a single slit. Elementary idea of polarization, Doppler effect of light.
Unit 21	Electromagnetic waves	Electromagnetic oscillations. Electromagnetic wave spectrum from gamma to radio waves - their use and propagation, properties of the atmosphere w.r.t. electromagnetic spectrum.
Unit 22	Electrons and Photons	Discovery of electrons, cathode rays, charge on an electron, e/m for an electron, photoelectric effect and Einstein's equation of photoelectric effect.
Unit 23	Atoms, Molecules and Nuclei	Rutherford model of the atom, Bohr's model, energy quantizations, hydrogen spectrum, Atomic masses, size of the nucleus; Radioactivity; rays and their properties - alpha, beta and gamma decay; half life and mean life of radio-active nuclei, Binding energy, mass energy relationship, nuclear fission and nuclear fusion.
Unit 24	Solids and Semi-Conductor Devices	Energy bands in solids, conductors, insulators and semi-conductors, PN junction, diodes, diode as rectifier, junction transistor, transistor as an amplifier.

CHEMISTRY

Unit 1	Atoms, Molecules and Chemical Arithmetic	Measurement in chemistry (significant figures, Dimensional analysis). Chemical classification of matter (mixtures, compounds and elements, and purification), Law of chemcial combination and Daiton's Atomic theory, Atomic Mass (mole concept, determination of chemical formulae). Chemical equation (balancing of chemical equation and calculations using chemical equations).
Unit 2	Elements, their Occurrence and extraction	Earth as a source of elements, elements in biology, extraction of metals (metallurgical process, production of concentrated ore, production of metals and their purification). Mineral wealth of India. Qualitative test of metals.

Unit 3	States of Matter	Gaseous state (measurable properties of gases, Boyle's Law, Charle's Law and absolute scale of temperature, Avogadro's hypothesis, ideal gas equation, Dalton's law of partial pressure). Kinetic molecular theory of gases (the microscopic model of gas, deviation from ideal behaviour). The solid state (classification of solids, X-ray studies of crystal lattices and unit cells, packing of constituent particles in crystals). Liquid state (Properties of liquids, Vapour pressure, Surface tension, Viscosity).
Unit 4	Atomic Structures	Constituents of the atom (Discovery of electron, Rutherford model of the atom). Electronic structure of atoms (nature of light and electromagnetic waves, atomic spectra. Bohr's model of Hydrogen atom. Quantum mechanical model of the atom, electronic configurations of atoms, Aufbau principle). Dual nature of matter and radiation. The uncertainty principle. Orbitals and Quantum numbers. Shapes of orbitals, Electronic configuration of atoms.
Unit 5	Chemical Families - Periodic Properties	Mendeleev's Periodic Table, Modern Periodic Law, Types of elements (inner transition elements-f-block elements). Periodic trends in properties. (Ionization energy, electron affinity, atomic radii, valence, periodicity in properties of compounds).
Unit 6	Chemical Bonding and Molecular structure	Chemical bonds and Lewis structure shapes of molecules (VSEPR theory). Quantum theory of the covalent bond (Hydrogen and some simple molecules, carbon compounds. Hybridization, Boron and Beryllium compounds). Coordinate covalent bond (Ionic bond as an extreme case of polar covalent bond, ionic character of molecules and polar molecules. Bonding in solid state (Ionic, moelcular and covalent solids, metals). Hydrogen bond, Resonance. Molecules: Molecular orbital method. Formation of H2,O2, N2, F2 on the basis of MOT. Hybridisation, Dipole moment and structure of molecules.
Unit 7	The Solid State	Structure of simple ionic compounds. Close-packed structures. Ionic-radii, Silicates (elementary ideas). Imperfection in solids (point defects only). Properties of solids, Amorphous solids. The Gaseous state. Ideal gas equation-Kinetic Theory (fundamentals only)
Unit 8	Solutions	Types of solutions, Vapour-pressure of solutions and Raoult's law. Colligative properties, Non-ideal solutions and abnormal molecular masses. Mole concept-stoichemistry, volumetric analysis-concentration unit.
Unit 9	Chemical Energetics and Thermodynamics	Energy changes during a chemical reaction, Internal energy and Enthalpy (Internal energy, Enthalpy, Enthalpy changes, Origin of Enthalpy change in a reaction, Hess's Law of constant heat summation, numericals based on these concepts). Heats of reactions (heat of neutralization, heat of combustion, heat of fusion and vaporization). Sources of energy (conservation of energy sources and identification of alternative sources, pollution associated with consumption of fuels. The sun as the primary source). Second law of thermodynamics : Entropy, Free energy, Spontaneity of a chemical reaction, free energy change and chemical equilibrium, free energy available for useful work.
Unit 10	Chemical Equilibrium	Equilibria involving physical changes (solid-liquid, liquid-gas equilibrium involving dissolution of solid in liquids, gases in liquids, general characteristics of equilibrium involving physical processes). Equilibria involving chemical systems (the law of chemical equilibrium, the magnitude of the equilibrium constant, numerical problems). Effect of changing conditions of systems at equilibrium (change of concentration, change of temperature, effect of catalyst-Le Chateliar's principle). Equilibria involving ions (ionization of electrolytes, weak and strong electrolytes, acid-base equilibrium, various concepts of acids and bases, ionization of water, pH, solubility product, numericals based on these concepts).

Unit 11	Redox Reactions and Electrochemistry	Oxidation and reduction as an electron transfer process. Redox reactions in aqueous solutions-electrochemical cells. EMF of a galvanic cell. Dependence of EMF on concentration and temperature (nearest equation and numerical problems based on it). Electrolysis, Oxidation numbers (rules for assigning oxidation number, redox reactions in terms of oxidation number and nomenclature). Balancing of oxidation-reduction equations. Electrolytic conduction, Voltaic cell. Electrode potential and Electromotive force, Gibb's free energy and cell potential. Electrode potential and Electrolysis.
Unit 12	Transference of Heat	Rate of reaction, Instantaneous rate of reaction and order of reaction. Factors affecting rates of reactions (factors affecting rate of collisions encountered between the reactant molecules, effect of temperature on the reaction rate, concept of activation energy, catalysis). Effect of light on rates of reactions. Elementary reactions as steps to more complex reactions. How fast are chemical reactions? Rate expression. Order of a reaction (with suitable examples). Units of rates and specific rate constants. Order of reaction and effect of concentration (study will be confined to first order only). Temperature dependence of rate constant - Fast reactions (only elementary idea). Mechanism of reaction (only elementary idea). Photochemical reactions.
Unit 13	Chemistry of Hydrocarbons	Alkanes (Structure, isomerism, conformation). Stereo isomerism and chirality (origin of chirality, optical rotation, recemic mixture). Alkenes (isomerism including cis-trans). Alkynes. Arenes (structure of benzene, resonance structure, isomerism in arenes). Sources of hydrocarbons (origin and composition of coal and petroleum, Hydrocarbon from coal and petroleum cracking and reforming, quality of gasoline-octane number, gasoline additives). Laboratory preparation of alkenes (preparation from alcohols, alkyl halides). Laboratory preparation of alkynes (preparation from calcium carbide and accetylene). Physical properties of alkanes (boiling and melting points, solubility and density). Reactions of hydrocarbons (oxidation, addition, subsitution and miscellaneous reactions).
Unit 14	Purification and Characterisation of Organic Compounds	Purification (crystallization, sublimation, distillation, differential extraction, chromatography). Qualitative analysis (analysis of nitrogen, sulphur, phosphorus and halogens). Quantitative analysis (estimation of carbon, hydrogen, nitrogen, halogens, sulphur, phosphorus and oxygen). Determination of molecular mass (Victor Mayer's method, volumetric method). Calculation of empirical formula and molecular formula. Numerical problems in organic quantitative analysis, modern methods of structure elucidation.
Unit 15	Organic Chemistry, Based on Functional Group-I	(Halides and Hydroxy compounds) Nomenclature of compounds containing halogen atoms and hydroxyl groups : haloalkanes, haloarenes; alcohols and phenols. Correlation of physical properties and uses. Preparation, properties and uses of following: Polyhalogen compound : Chloroform, Idoform Polyhydric compounds, Ethane 1, 2-diol; Propane-1,2,3 triol Structure and reactivity - (a) Induction effect, (b) Mesomeric effect, (c) Electrophiles and Nucleophiles. (d) Types of organic reaction.
Unit 16	Magnetic Effects of Currents	(Ethers, aldehydes, ketones, carboxylic acids and their derivatives) Nomenclature of ethers, aldehydes, ketones, carboxylic acids and their derivatives. (acylhalides, acid anhydrides, amides and esters) General methods of preparation, correlation of physical properties with their structures, chemical properties and uses. (Note : Specific compounds should not be stressed for the purpose of

		evaluation)
Unit 17	Organic Chemistry Based on Functional Group-II	(Cyanides, isocyanides nitrocompounds and amines) Nomenclature and classification of amines, cyanides, isocyanides, nitro compounds and their method of preparation; correlation of physical properties with structure, chemical reactions and uses.
Unit 18	Chemistry of Non-metals-I	(Hydrogen, Oxygen and Nitrogen) Hydrogen (position in periodic table, occurrence, isotopes, properties, reactions and uses) Oxygen (occurrence, preparation, properties and reactions, uses, simple oxides; ozone) Water and hydrogen peroxide (structure of water molecule and its aggregates, physical and chemical properties of water, hard and soft water, water softening, hydrogen peroxides-preparation, properties, structure and uses). Nitrogen (Preparation, properties, uses, compounds of Nitrogen-Ammonia, Oxides of Nitrogen, Nitric Acid-preparation, properties and uses).
Unit 19	Chemistry of Non-metals-II	(Boron, Carbon, Silicon, phosphorus, sulphur, halogens and the noble gases) Boron (occurrence, isolation, physical and chemical properties, borax and toxic acid, uses of boron and it compounds). Carbon, inorganic compounds of carbon (oxides, halides, carbides), elemental carbon. Silicon (occurrence, preparation and properties, oxides and phosphorus, chemical fertilizers). Sulphur (occurrence and extraction, properties and reaction oxides; Sulphuric acid - preparation, properties and uses, sodium thiosulphate). Halogens (occurrence, preparation, properties, hydrogen halides, uses of halogens). Noble gases (discovery, occurrence and isolation, physical properties, chemistry of noble gases and their uses).
Unit 20	Chemistry of lighter Metals	Sodium and Potassium (occurrence and extraction, properties and uses, important compounds - NaCl, Na2Co3, NaHCO3, NaOH, KCl, KOH). Magnesium and calcium (occurrence and extraction, properties and uses, important compounds MgCl2, Mg SO4, CaO, Ca(OH)2,CaCO3,CaSO4, plaster of paris). Aluminium (occurrence, extraction, properties and uses, compounds - AICI3, alums). Cement. Biological role of Sodium, Potassium, Magnesium and Calcium.
Unit 21	Chemistry of heavier Metals	Iron (Occurrence and extraction, compounds of iron, oxides, halides, sulphides, sulphate, alloy and steel). Copper, silver and gold (occurrence and extractions, properties and uses, compounds - sulphides, halides and sulphates, photography). Zinc and Mercury (occurrence and extraction, properties and uses, compounds - oxides, halides; sulphides and sulphates). Tin and Lead (occurrence and extraction, properties and uses, compounds - oxides, sulphides, halides).
Unit 22	Chemistry of Representative Elements	Periodic properties - Trends in groups and periods (a) Oxides-nature (b) Halides-melting points (c) Carbonates and sulphates-solubility. The chemistry of s and p block elements, electronic configuration, general characteristic properties and oxidation states of the following:- Group 1 elements - Alkali metals Group 2 elements - Alkaline earth metals Group 13 elements - Boron family Group 14 elements - Carbon family Group 15 elements - Nitrogen family Group 16 elements - Oxygen family Group 17 elements - Halogen family Group 18 elements - Noble gases and Hydrogen
Unit 23	Transition Metals including Lanthanides	Electronic configuration: General characteristic properties. States of transition metals. First row transition metals and general properties of

		their compounds - oxides, halides and sulphides. General properties of second and third row transition elements (Groupwise discussion). Preparation, properties and uses of Potassium dichromate, Potassium permanganate. Inner Transition Elements General discussion with special reference to oxidation states and earmthanide contraction.
Unit 24	Coordination Chemistry and Organs Metallics	Coordination compounds, Nomenclature : Isomerism in coordination compounds; Bonding in coordination compounds, Werner's coordination theory.
Unit 25	Nuclear Chemistry	Nature of radiation from radioactive substances; Nuclear reactions; Radioactive disintegration series; Artificial transmutation of elements; Nuclear fission and Nuclear fusion; isotopes and their applications: Radio carbon-dating.
Unit 26	Synthetic and Natural Polymers	Classification of Polymers, natural and synthetic polymers (with stress on their general methods of preparation) and important uses of the following: Teflon, PVC, Polystyrene, Nylon-66, teryleneEnvironmental pollution - pollutants - services - check and alternatives.
Unit 27	Surface Chemistry	Surfaces : AdsorptionColloids : (Preparation and general properties), Emulsions, MicellesCatalysis : Homogeneous and heterogeneous, structure of catalyst.
Unit 28	Bio Molecules and Biological Processes	The Cell Carbohydrates : Monosaccharides, Disaccharides, Polysaccharides Amino Acides and Peptides - Structure and classification. Proteins and Enzymes - Structure of Proteins, Role of enzymes. Nucleic Acids - DNA and RNA Biological functions of Nucleic acids - Protein synthesis and replication Lipids - Structure, membranes and their functions.
Unit 29	Chemistry in Action	Dyes, Chemicals and medicines (antipyretic, analgesic, and tranquilisers), Rocket propellants. (Structural formulae non-evaluative).