Appendix-VIII

SYLLABUS FOR ENTRANCE EXAMINATION OF UNDERGRADUATE PROGRAMME

MENTAL AGILITY

No Syllabus is prescribed.

MATHEMATICS

1. **ALGEBRA:** Elements of set theory, Relations and Functions, Mathematical induction, Number System, Arithmetic, Geometric and Harmonic progressions, quadratic equations, partial fractions, permutations and combinations, Binomial Theorem, Exponential and logarithmic series, Matrices and determinants, solution of simultaneous algebraic equations.
2. **PROBABILITY:** Definition, dependent and independent events, problems based on addition and multiplication theorems of probability.
3. **TRIGONOMETRY:** Trigonometry functions, Periodic functions, identities, Trigonometric equation, solution of triangles, height and distance, inverse trigonometric functions, complex number, De-Moiver's Theorem.
4. **COORDINATE GEOMETRY:** Elementary Coordinate Geometry, Straight lines, Family of straight lines, circles, sections of a cone, Equations of Conic sections-parabola, ellipse and hyperbola in standard form.
5. **CALCULUS:** Functions, limits and continuity, differentiation, simple cases, functions of a function, tangents and normals, simple maxima and minima. Integration of simple functions by parts, by substitution and by partial fraction, definite integrals, differential equations.
6. **VECTOR:** Position vectors, addition and subtraction of vectors, scalar and vector products of two and three vectors.
7. **DYNAMICS:** Velocity, acceleration, composition and resolution of velocity and acceleration, laws of motion, work, power and energy, motion under gravity and projectiles, principles of conservation of momentum and energy. Direct impact on smooth bodies.
8. **STATICS:** Composition and Resolution of coplanar and parallel forces, moments and couples, resultant of set of co-planar forces and conditions of equilibrium, determination of centroids in simple cases and frictions.

PHYSICS

Physical measurements, System of units, Dimensions, Errors in measurement, Motion in one, two and three dimensions, Laws of motion, Work, Energy and power, Center of mass, Rigid bodies, Rotational motion, Gravitation, Acceleration due to gravity, Gravitational potential energy, Geostationary satellites.

Brownian motion, Avogadro's hypothesis and Avogadro's number, Inter-atomic and intermolecular forces, States of matter, Crystalline and glassy solids, Elasticity, Pressure, Archimede's principle, Viscosity, Fluid flow, Surface tension.

Kinetic theory of gases, Temperature, Thermal expansion, Heat, Specific heat, Heat capacity, First and second laws of thermodynamics, Heat engines, Transfer of heat.

Periodic motion, Time period and frequency, Simple harmonic motion, Springs, Kinetic and potential energy in SHM, Simple pendulum, Forced oscillations, Resonance, Free and damped oscillations, Superposition principle of waves, Harmonic waves, Reflection of waves, Standing and traveling waves, Beats, Doppler effect.

Properties of electric charge, Coulomb's law, Lines of force, Electric dipole, Electric flux, Electric field, Gauss's theorem, Electrostatic potential, Potential energy, Capacitors and capacitance, Current, Voltage, Resistance, Ohm's law, Kirchhoff's laws, Ammeter, Voltmeter, Chemical and thermal effects of currents, Thermoelectricity.

Magnetic field due to a current, Biot-Savart law, Lorentz force, Amperes law, Magnetic dipole moment, Torque, Galvanometer, Moving charges in magnetic and electric fields, Field of a bar magnet, Magnetic field lines, Magnetic flux, Magnetic field of earth, Tangent galvanometer.

Faraday's law of induction, Lorenz's law, Lorentz force, Inductance, RC, LR and LCR circuits, Power flow in AC circuits, Resonance and oscillations, Electromagnetic waves, em-wave equations, Spectrum of e.m. waves and light.

Light rays, Wavefronts, Coherent and incoherent sources, Interference, Diffraction and Polarization of light, Luminousity, Velocity of light, Reflection from spherical surfaces, Refraction at spherical surfaces, Lenses, Dispersion and spectroscopes, Optical defects in mirrors and lenses, Optical instruments, Microscope, Telescope, Cathode rays, e/m of electrons, Photoelectric effect, Photocell, Wave nature of matter.

Atomic masses, Binding energy, Size of the nucleus, Radioactivity, Nuclear energy, Fission and fusion reactions.

Molecules, Molecular energies, Rotational and vibrational spectra, Solids and their structures, Semiconductors, Semiconductor diodes, Transistors.

BIOLOGY

BOTANY

1. Morphology of root, stem and leaf and their modifications.
2. Flower, inflorescence, seed and fruits.
3. Development of male and female gametophytes, pollination, fertilization and development of embryo.
4. Germination, growth and development.
5. Cell and cellular functions, tissues, anatomy of root, stem and leaf of both monocot and dicots, secondary growth.
6. Elementary study of Plant Physiology.
   (a) Structure of root hair, uptake of water and minerals root pressure and transpiration.
   (b) Structure of stomata, function, factors, and carbon assimilation.
   (c) Translocation and storage of food materials.
   (d) Respiration
   (e) Mineral nutrition and metabolism
   (f) Plant hormones and vitamins.
7. Plant taxonomy and elementary study of the following families:
   (a) Brassicaceae (b) Leguminosae (c) Malvaceae (d) Solanaceae (e) Cucurbitaceae (f) Asteraceae
   (g) Poaceae (Gramineae)
8. Classification of plant kingdom. A brief study of the following groups/plants:
   (a) Viruses (b) Bacteria (c) Spirogyra (d) Mucor/Rhizopus (e) Moss (f) Fern (g) Cycas
9. Natural resources and their conservation; environment and pollution-air, water and soil community, ecosystem, pyramids, energy flow, mineral cycles, and succession.
10. Plant tissue culture, biotechnology and its applications.

ZOOLOGY

1. A brief account of classification of animal kingdom with reference to animal biodiversity including both invertebrates and vertebrates.
2. Physiology of animals with emphasis on Human. Homeostasis, nutrition and digestion, circulation, respiration, reproduction, excretion, co-ordination and endocrine.
3. Embryology of human
4. A brief account of animal biotechnology. Immune system and human health, DNA, Gene and genetic engineering.
5. Cell and cell division.
6. Mendelism, sex determination, sex linked inheritance, genetic disorders and polyploidy.
7. Biological molecules including carbohydrates, lipids, proteins and nucleic acids.

CHEMISTRY

ATOMS AND ATOMIC STRUCTURE

Measurements in Chemistry (Significant figures, S.I. Units), Mole concept, Nature of light and electromagnetic waves, atomic spectra, Bohr model, line spectra (a brief idea). In adequacy of Bohr's Model, concept of an atomic orbital, quantum numbers and its application to electronic structures of atoms). Pauli's exclusion principle. Aufbau principle, Stability of filled & half-filled orbital Configuration of transition elements in 3d series. Dual nature of particle and radiation (photoelectric effect etc.) de-Broglie equation, uncertainty principle (simple numerical problems), Hund's rule.

PERIODIC PROPERTIES OF ELEMENTS

Periodic law, long form of periodic table, Periodicity in properties like atomic radii and volume, ionic radii, ionization energy, electron affinity. Division of elements into s, p, d and f blocks.

CHEMICAL BONDING AND MOLECULAR STRUCTURE

Concept of orbital overlap in bond formation, sigma and pi bonds shapes. of molecules (VSEPR) Theory, hybridization (sp, sp^2, sp^3, dsp^2 sp^3d, sp^3d^2), properties of covalent compounds, shapes of simple molecules like H_2O, NH_3 CH_4 PF_5 SF_6 C_2H_4 and C_2H_2. Coordinate bond formation with a few examples, Ionic bonds; definition, factors influencing the formation of ionic compounds. An elementary treatment of metallic and hydrogen bonds. Idea of molecular orbital, bonding and anti boding, molecular orbital picture in hydrogen and oxygen molecules only.

CHEMISTRY OF REPRESENTATIVE ELEMENTS

The chemistry of s and p block elements with reference to general trends in physical and chemical properties, anomalous behavior of first member of each group, diagonal relationship.

Group 1 Elements: Alkali metals; Group 2 Elements: Alkali earth metals; Group 13 Elements: Boron family; Group 14 Elements: Carbon and silicon family; Group 15 Elements: Nitrogen family;

Group 16 Elements: Oxygen family; Group 17 Elements: Halogen family; hydrogen; Group 18 Elements: Noble gases;

Preparation and properties of a few important compounds of representative elements (like halides, oxides and oxy acids etc.)

COORDINATION CHEMISTRY AND ORGANOMETALLICS

Coordination Compounds nomenclature; Isomerism in Coordination compounds; Bonding in Coordination compounds; Valence Bond Theory Application of Coordination Compounds; Compounds containing metal carbon bonds; Application of organometallics.

CHEMICAL THERMODYNAMICS

Energy changes during a chemical reaction. First law of thermodynamics. Concepts of internal energy and enthalpy. Application of first law of thermodynamics. Hess's law of constant heat summation, Heat of reaction, Heat of neutralization, heat of combustion, heat of fusion and vaporization. Numericals based on the above concepts.

Second law of Thermodynamics: Entropy, free energy, spontaneity of a chemical reaction, free energy and chemical equilibrium, free energy available for useful work. Third law of Thermodynamics (concept of zero entropy only).

CHEMICAL EQUILIBRIUM & PHASE EQUILIBRIUM

Law of mass action and its application to chemical equilibrium.

Effect of changing the conditions of system at equilibrium-Le-Chatelier's principle.

IONIC EQUILIBRIUM IN SOLUTION

Equilibrium involving ions, various concepts of acids and bases-Arrhenius, Bronsted, Lowery and Lewis, dissociation of acids and bases, acid-base equilibria, ionization of water, pH scale, hydrolysis of slats, pH calculation of solutions, acid base titration using indicators. Solubility equilibria-solubility of sparingly soluble salts, solubility equilibria and solubility products, common ions effect, buffer solution and buffer action.

REDOX REACTIONS

Oxidation and reduction-electron transfer concept, redox reactions in aqueous solution, oxidation number, balancing of chemical equations in redox reactions by oxidation number method and ion-electron method or half equation method.

CHEMICAL KINETICS

Rate of reaction-symbolic expression, rate expression. Units of rates and specific rate constants. Order of reaction, molecularity. Determination of order of reaction and concentration (first order reactions only). Temperature dependence of rate constant. Activation energy, Photochemical reactions.

STATES OF MATTER

Gaseous state: Properties of a gas, gas laws, kinetic molecular theory of gases, Solid state. Classification of solids, X-ray studies of crystal lattices & unit cell. Liquid slate, Properties of Liquids like vapour pressure, surface tension, viscosity.

NUCLEAR & RADIOCHEMISTRY

Nature of radiation from radioactive substances; nuclear structure and nuclear properties, Nuclear reaction, radioactive disintegration series, artificial transmutation of elements. Isotopes and their uses. Radio carbon dating. Synthetic elements.

SOLUTIONS

Types of solutions, Vapour pressure of solutions and Raoults' law. Colligative properties of solutions. Calculation of molecular masses. Electrolyte solutions, distribution law.

COLLOIDS AND MACROMOLECULES

Colloidal solutions, electroinetic and optical of colloidal Solutions, properties, applications, concept of gold number, protective colloids, Macromolecules, molecular weight of macromolecules, methods of determining molecular weight of macromolecules.

SURFACE AND CATALYSIS

Absorption and adsorption, emulsions, micelles, modern developments, Interfaces, Homogeneous and heterogeneous catalysis, structure of a catalyst.

CARBON AND ITS COMPOUNDS INTRODUCTION TO CARBON COMPOUNDS

Elemental Carbon. Inorganic compounds of carbon (oxides and carbides)

HYDROCARBONS

Alkanes: sp^3-hybridization, sigma bond, chain isomerism; Alkanes sp^2 hybridization, carbon-carbon double bond, sigma and bi-bonds. Planer molecular of ethylene cis-trans isomerism; Alkanes: sp-hybridization C (C, linear molecule of acetylene); Arenes: Delocalisation of electronics in benzene, Resonance structure of benzene: o.m.p. –isomers ; Systematic nomenclature of organic compounds.

PREPARATION AND PROPERTIES OF HYDROCARBONS

Source of hydrocarbons (composition of coal and petroleum, hydrocarbons from coal and petroleum, cracking and reforming, quality of gasoline-octane number, gasoline additives).

Laboratory preparation of alkanes (preparation from unsaturated hydrocarbons, alkyl halides and carboxylic acids) ; Laboratory preparation of alkynes (Preparation from alcohol and alkyl halides); Laboratory preparation of alkynes (Preparation from calcium carbide and acetylene) ; Physical properties of alkanes (boiling and melting points, solubility and density)

Reactions of hydrocarbons, (oxidation, additions, substitutions and miscellaneous reactions).

PURIFICATION AND CHARACTERIZATION OF ORGANIC COMPOUNDS

Purification (crystallization, sublimation, distillation, differential extraction and chromatography), Qualitative analysis of elements. Quantitative analysis (estimation of carbon, hydrogen, nitrogen, halogen). Determination of molecular mass (Victor Mayer's Method). Calculation of empirical and molecular formulae from weight percentage data of elements and molecular weight.

ORGANIC CHEMISTRY BASED ON FUNCTIONAL GROUPS

HALIDES AND HYDROXY COMPOUNDS

Nomenclature of compounds containing halogen atoms and hydroxyl group; haloarens, alcohols and phenols, correlation of physical properties and uses. A few important polyhatogen compounds-chloroforms, carbon tetrachloride, DDT, benzene hexachloride. Polyhydric compounds, ethane 1.2-diol. Propane 1,2,3, triol.

ORGANIC CHEMISTRY BASED ON FUNCTIONAL GROUPS-I

Ethers, aldehdes ketones, carboxylic acids and their derivatives. Nomenclature of ethers, aldehydes ketones, carboxylic acids and their derivative. Acylhalides, acid anhydride, amides and esters, methods of preparation, correlation of physical properties with their structures, chemical properties & uses.

ORGANIC CHEMISTRY BASED ON FUNCTION GROUPS-II

Nitrogen compounds. A brief description of the chemistry of the carbon compounds containing nitrogen (cyanides, isocyanides, nitro-compounds and amines) and their methods of preparation; correlation of physical properties with structure, chemical reaction, uses.

SYNTHETIC AND NATURAL POLYMERS

Classification of polymers, some important natural and synthetic polymers (with stress on their general methods of preparation); some common examples and their important uses.

BIO CHEMISTRY: (Structures of complicated molecules excluded)

CARBOHYDRATES: Monsaccharides, Disaccharides, Polysaccharides.

AMINO ACIDS AND PEPTIDES: Structure and classification, properties of amino acids and peptides, biologically important peptides.

PROTEINS AND ENZYMES: Structure of proteins, some important proteins, enzymes.

NUCLEIC ACIDS: Chemical properties of nucleic acids, Biological functions of nucleic acids, protein synthesis.

LIPIDS: Classification, structure and function.

AGRICULTURE

AGRONOMY

Cultivation of common crops-wheat, paddy, cotton, jowar, bajra, maize, soybean, arhar, mustard, sunflower, pea, groundnut, gram, tobacco, barseem, potato and sugarcane under the following heads:

Recommended varieties and their main characteristics, suitable areas, seed rate, time and method of sowing, irrigation, fertilizer use, control of weeds, insect-pests and diseases, harvesting, processing and yield.

Soils-origin and classification loam, silt, clay, sandy loam, etc.; physical and chemical properties; soil conservation. Use of fertilizers, essential nutrients- nitrogen, phosphorus and potassium uptake by different crops, organic and inorganic fertilizers and their effects on crops and soil, methods of using fertilizers, farmyard manure, composting, green manauring, study of organic and inorganic fertilizers/ manures. Pollution of soil, water and air in modern agriculture and remedial measures.

Irrigation and Drainage – water requirement of crops, measurement of water discharge, prevention of loss of water; quality of water; different methods of irrigation – flooding, basin method, border /strip method, sprinkler and drip irrigation – their advantages and limitations. Necessity for drainage, damage to soil and crops due to excess moisture, prevention of formation of acidic and alkaline soils and their management; natural calamities- floods and drought and their management.

HORTICULTURE

Study of following horticultural crops including recommended varieties and their main features, suitability for different regions, time and method of sowing, fertilizer use, irrigation, diseases and pests and their control.

Crops- cabbage, cauliflower, onion, garlic, cucurbits, bittergourd, bottlegourd, muskmelon, squash, ridgegourd; root crops-carrot, radish sweet potato, turnip; peas, tomato, bringal, lady's finger, spices; fruit crops such as banana, apple, mango, litchi, citrus, guava, papaya, peach etc.

AGRICULTURAL ENGINEERING

Type of iron and steel, wood, plastic and tin used in agricultural implements and their forms & properties. Study of different types of ploughs-their merits and demerits; mechanical devices such as cultivator, harrow, sprayer, seed drill, thereshers etc. their management & cost, selection of prime movers, water lifting devices; discharge, command area, cost of different system; soil preparation, methods of ploughing, need for tillage, kinds of tillage, interculture, equipment for interculture.

Power transmission through belts, pullies and gears, questions relating to number of teeth in gears according to speed and size of pullies, hand operated chaff cutters, cane crusher etc., draught and its measurement.

AGRICULTURAL ECONOMICS

Introductory agricultural economics-meaning and scope, significance of agricultural economics in national planning. Production – meaning, factors of production such as land, labour, capital and management, properties of factor of production; law of returns; intensive and extensive agriculture; Exchange - meaning, types, advantages; types of markets, general price determination; money and credit; banks and their functions; principle of international trade, Distribution-meaning, rent, wages, interest and profit; Consumption -meaning, wants and their properties, law of diminishing marginal utility, law of demand, relative prices and standard of living; Cooperation - meaning, principles of cooperation, types of cooperative societies in agriculture, single purpose and multi-purpose cooperative societies, land development banks: Agriculture-place in Five Year Plans; statistics of agricultural production in the State; Major programmes of agricultural development.

ANIMAL HUSBANDRY AND VETERINARY SCIENCE

Study of major breeds of cows, buffaloes, goat, sheep and poultry; elementary physiology and anatomy of cows and bullocks; estimate of their age; characteristics of good milch cows and buffaloes, bulls and bullocks.

Care and management of pregnant cow, during calving, newborn calves, young calves, mulch cows; poultry management.

Principles of feeding of various classes of livestock and poultry. Economic feeds for various classes of livestock and poultry. Clean milk production and maintenance of hygiene.

Common medicines and vaccines used in treatment/prevention of animal diseases; handling of animals for treatment; castration. Operation flood, Milk and Milk products, Identification of Adult rated milk.

Note: Questions from similar topics can also be included.