

## SYLLABI

### 7.1 [PHARMACY/Bachelor of Homoeopathic Medicine and Surgery (BHMS) / Bachelor of Ayurvedic Medicine and Surgery (BAMS) /

The Syllabi given hereunder for OJEE-2018 are only illustrative and not exhaustive. The syllabi are in line with courses of studies in Science stream for the Higher Secondary Examination 2018 of CHSE, ODISHA. Since OJEE is conducted with a view to preparing merit lists for admission the decision of the OJEE Committee as regards the scope of the syllabus is FINAL.

#### 7.1.1 PHYSICS (45 Questions)

**Measurements and Motion:** Fundamental and derived physical quantities, Concept of Mass, Length and Time, Measurement of different quantities in SI Units. Errors in measurement, Combination of errors, Dimension of physical quantities, Dimension analysis of physical quantities- Conversion of physical quantities from one system of units to another. Concepts of vectors and scalars, Components of vectors, Unit vectors, Addition, Subtraction and Multiplication (vector & scalar) of vectors. Lami's Theorem. Equations of linear motion for uniformly accelerated bodies (by calculus method). Newton's laws of motion, Conservation of energy and momentum, Collision in one dimension, Work, Power, Energy, Sliding and Rolling friction. Circular Motion- radial and tangential acceleration, Centripetal force, Banking of tracks, Kepler's laws of Planetary Motion (Statements only). Newton's law of Gravitation. Earth satellites- Orbital and Escape velocities. Moment of Inertia- definition and expression of Moment of Inertia for rod, ring and circular disc (about an axis passing through the centre and perpendicular to the plane of the body). Angular momentum and Conservation of angular momentum, Projectile motion.

**Heat & Thermodynamics:** Concept of Temperature, Scales of Temperature (Celsius, Fahrenheit, Kelvin), Definition of mechanical equivalent of heat (J), Thermal energy, Heat Capacity, Specific heat of solids and liquids, Latent heat, Heat transfer- Thermal conductivity of solids, Steady state, Kirchhoff's laws of heat radiation, Stefan's law of heat radiation, Newton's Law of cooling.

Kinetic Theory of gases- Pressure of an ideal gas, Kinetic interpretation of temperature, Degrees of freedom, Law of equipartition of energy.

First Law of Thermodynamics, Specific heats of a gaseous system, Relation between  $C_p$  and  $C_v$ , Work done during Isothermal and Adiabatic processes, Carnot's conceptual heat engine and its efficiency, Second law of thermodynamics, Absolute Scale of Temperature.

**Characteristics of Materials:** Elastic and Plastic behaviors of solids, Elastic limit, Young's modulus, Shear and Bulk modulus, Poisson's ratio.

**Liquids :** Surface Tension and Surface Energy, Excess pressure across a spherical liquid surface, Expression for capillary rise. Streamlined and turbulent flow, Bernoulli's equation and its application, Viscosity- coefficient of viscosity, Stokes law.

**Electricity & Magnetism :** Electric field intensity and Potential at a point in an electric field, Relation between them, Capacitance- dielectric constant and its effect on capacitance. Series and parallel grouping of capacitances, Energy stored in a charged capacitor, Ohm's law, Variation of resistance of metallic conductors with temperature, Kirchhoff's laws and its application to a balanced Wheatstone bridge. Combination of Cells and resistors- series and parallel. Heating effect of electric current and Joule's law, Electric power and electric energy.

Magnetic Permeability and Susceptibility of materials, Properties of dia, para and ferro magnetic materials. Biot-Savart's law- Magnetic Field due to a circular coil at its centre. Moving coil galvanometer (dead beat only). Force on a moving charge in a uniform magnetic field. Faraday's laws of electromagnetic induction, Lenz's law, emf induced in a rotating coil in a magnetic field. Alternating current- Self and Mutual induction, Phase relation between Voltage and Current in pure resistive, capacitive and inductive circuits. Principle of transformer, elementary idea on electromagnetic waves.

**Wave motion:** Simple harmonic motion, wave propagation, characteristics of wave motion, longitudinal and transverse waves, superposition of waves:- Stationary waves, Beats. Open and

closed organ pipes, velocity of sound in air- effect of pressure, temperature and humidity on it. Doppler Effect, laws of transverse vibration of string (Statement only).

**Optics:** Reflection and refraction at curved surfaces. Spherical mirror and thin lens formula and refraction through prism. Total internal reflection, Dispersion, Huygens principle (statement only), Young's double slit experiment.

**Electronic Devices:** Thermionic emission, Statement of Richardson's equation and Child's Law, Vacuum triode- construction and characteristics, relationship between valve constants, Descriptive idea of energy bands:- conductors, insulators and semi conductors, Intrinsic and extrinsic semiconductors, p-type and n-type semiconductors. PN junction, PNP and NPN transistor, PN Junction as a rectifier.

**Relativity and Nuclear Physics:** Postulates of special theory of relativity, variation of mass with velocity (Statement only), mass energy equivalence relation (Statement only). Atomic nucleus, nuclear forces, nuclear mass, binding energy, mass defect, artificial radio activity, radio isotopes and their uses. Nuclear fission, energy released during nuclear fission, chain reaction, controlled chain reaction, nuclear fusion, energy generation in the Sun, radiation hazards.

## 7.1.2 CHEMISTRY(45 Questions)

### General behaviour of matter:

**Solid State :** Characteristics, Classification, Solubility, Melting points, Crystal structure of simple ionic compounds. Radius ratio and coordination number: density calculation, lattice points and voids.

**Liquid State :** Characteristics, Boiling and Freezing points, Viscosity, Surface tension, Osmosis, Raoult's law, Lowering of vapour pressure, Depression of freezing points, Elevation of boiling points, Anomalous molecular masses; Association and dissociation.

**Solutions :** Types of solutions, concentration and different ways of expressing concentration (percentage, ppm, strength, normality, molarity, molality and formality); Interrelations

**Gaseous State :** Gas laws, Kinetic model of gases, ideal gas equation, Van der waals' equation, compressibility factor, Average, root mean square and most probable velocities.

**Atoms and molecules :** Symbols, Valency, Atomic mass, Molecular mass, Avogadro's law, Mole concept, Determination of equivalent mass of zinc and copper, Atomic mass by Dulong Petit's method and Molecular mass by Victor Mayor's method. Stoichiometry and calculations based on stoichiometry.

**Structure of atoms and molecules :** Fundamentals particles and their properties, Rutherford and Bohr models of atom, Hydrogen spectrum, Energy levels, Shells and Sub-shells, s,p and d orbitals, Quantum numbers, Pauli's exclusion principle, Aufbau-principle, Hund's rule, Electronic configuration of atoms, Extra stability of half filled and filled subshells.

**Chemical bonds :** Ionic, Covalent, Coordinate and Hydrogen bond, Hybridisation-  $sp$ ,  $sp^2$ ,  $sp^3$ ,  $dsp^2$ ,  $dsp^3$ ,  $d^2sp^3$  shapes of molecules, VSEPR theory, Molecular Orbital Theory of simple diatomic molecules.

**Periodic classification :** Periodic table and periodic laws, s, p, d and f block elements, Periodicity in properties such as atomic and ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity and oxidation states.

### Chemical energetics, equilibrium and kinetics:

**Energetics:** Internal energy, Enthalpy, Heats of reactions, Bond energy, Hess's law, Idea on enthalpy, entropy and free energy, spontaneity and conditions of equilibrium.

**Equilibria :** Reversible reaction, Law of mass action, Equilibrium constant  $K_p$ ,  $K_c$ ,  $K_x$  and their relation. Its application to ammonia synthesis and dissociation of HI, Decomposition and thermal dissociation. Theory of acids and bases, Dissociation of weak acids and bases, Ostwald's dilution law, Ionic product of water, Common ion effect, Solubility product and their applications, pH, Hydrolysis of salts, Buffer solutions.

**Kinetics :** Rate of reaction, Factors affecting the rate, Rate constant, Order and Molecularity of a reaction, Simple zero and First order reaction, Half life period, Arrhenius equation and Activation

Energy, Collision theory (qualitative idea only)

**Types of chemical reaction** : Neutralisation and oxidation– Reduction reaction, Equivalent mass, Oxidation number, Balancing chemical reactions, by Ion electron method, Reactions involving  $\text{KMnO}_4$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ ,  $\text{Na}_2\text{S}_2\text{O}_3$ , oxalate etc.

**Non-metals** : Group study, Preparation, Properties and uses of elements of compounds of hydrogen (ortho and para hydrogen, isotopes of hydrogen,  $\text{D}_2\text{O}$  and  $\text{H}_2\text{O}_2$ ). Allotropes of carbon, Nitrogen family ( $\text{NH}_3$  and  $\text{HNO}_3$ ). Oxygen and sulphur family ( $\text{O}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{SO}_2$ ,  $\text{H}_2\text{SO}_4$  and its manufacturer by contact process), Halogens, Hydrogen halides and Interhalogen compounds, Zero group elements (properties & uses).

**Electrochemistry** : Electrolysis, Electrical Conductivity (Specific, Equivalent and molar), Faraday's laws, Kohlvauseh law, Galvanic cell, Cell reaction, Nernst equation, Standard electrode potential, Electro chemical series e.m.f. of simple cells. Fuel cells.

**Nuclear chemistry** : Radio activity, Rate of disintegration, Group displacement law, Half-life and average life period, Stability of nuclear (N/P ratio) Carbon dating, Nuclear Fission and Fusion. Induced radioactivity by protons, neutrons and alpha particles.

**Metals and metallurgy** : Occurrence of metal, Minerals and ores, flux, slag calcination, roasting, smelting (by reduction of oxides) and refining. General trends in the characteristics, principles of extraction of Na, Mg, Ca, Al, Cu and Fe and their oxides, hydroxides, chlorides, nitrates and sulfates.

**Organic chemistry:**

**Introductory** : Functional Groups and organic radicals, Nomenclature by IUPAC system (substitutive method) , Isomerism (Structural and stereoisomerism – optical and geometrical) EZ & RS nomenclature, Electron mobility – Inductive effect, Resonance, Electromeric effect and Hyperconjugation; their applications. Types of organic reactions – addition, substitution, elimination reactions. Idea of electrophiles and nucleophiles; Reaction intermediates – idea of carbocations, carbanion & free radicals; their stabilities.

**Aliphatic compounds:** Methods of preparation and properties of alkanes, alkenes, alkynes (acidity of terminal alkynes), haloalkanes, alcohols, aldehydes, ketones, carboxylic acids, acid derivatives (acid chlorides, esters and amides), nitroalkanes and amines.

**Aromatic compounds** : Aromaticity (Huckel's rule), Aromatic hydrocarbon (Preparation and reactions – Substitution, addition, ozonolysis) Phenols (Preparation and reactions) : Aldehydes (Preparations and reactions); Acids (Preparation and reactions). Amines (Preparation and reactions); Diazonium salts (synthetic application).

**Biochemistry** : Biological importance of organic compounds such as carbohydrates, amino acids, proteins, lipids and nucleic acids (only by metabolic process).

**Chemistry in the service of mankind** : General idea on fertilizers, pesticides, polymers (nylon, terylene, neoprene, buna-S, PVC, Teflon & bakelite). Medicine-analgesic, antipyretic, antibiotic and antiseptic (structure and preparation not required).

**Environmental chemistry:** Source, effect and control measures of air and water pollution.

### 7.1.3 MATHEMATICS(45 Questions)

**Logic** :Statement, Negation, Implication, Converse, Contrapositive, Conjunction, Disjunction, Truth Table. Different methods of proof, Principle of Mathematical induction.

**Algebra of sets** : Set operation, Union, Intersection, Difference, Symmetric difference, Complement, Venn diagram, Cartesian product of sets, Relation and functions, Equivalence relation, Kinds of functions and their domain and range, Composite function, Inverse of a function.

**Number system** : Real numbers (algebraic and order properties, rational and irrational numbers), Absolute value, Triangle inequality, AM & GM, Inequalities(simple cases), Complex numbers, Algebra of complex numbers, Conjugate and square root of a complex number, Cube roots of unity, De Moivre's theorem with simple application. Permutations and Combinations - simple applications, Binomial theorem for positive integral index, Identities involving binomial coefficients.

**Determinants and matrices** : Determinants of third order, Minors and cofactors, Properties of

determinants, Matrices upto third order, Types of matrices, algebra of matrix, adjoint and inverse of matrix, Application of determinants and matrices to the solution of linear equations (in three unknowns).

**Trigonometry** : Compound angles, Multiple and Submultiple angles, Solution of trigonometric equations, Properties of triangles, Inverse circular function, Sum and product of sine and cosine functions.

**Co-ordinate geometry of two dimensions** : Straight lines, Pairs of straight lines, Circles, Equations of tangents and normals to a circle, Equations of parabola, Ellipse and hyperbola in simple forms, their tangents and normals. Condition of tangency. Rectangular and Conjugate hyperbolas.

**Coordinate geometry of three dimensions** : Distance and Division formulae, Direction cosines and direction ratios, Projection, Angle between two planes, Angle between a line and a plane. Distance of a point from a line and a plane. Equation of a sphere – general equation, Equation of sphere when end points of diameter are given.

**Quadratic polynomials** : Roots of quadratic polynomial, Factorisation of quadratic polynomials, Maximum and minimum values of quadratic polynomials for all real values of the variable, sign of the quadratic polynomial for all real values of the variable, Solution of quadratic inequations.

**Sequence and Series** : Definition, Infinite geometric series, Arithmetico-geometric series, Exponential and Logarithmic series.

**Vectors** : Fundamentals, Dot and cross product of two vectors, Scalar triple product and vector triple product, Simple application of different products.

**Differential calculus**: Concept of limit, Continuity of functions, Derivative of standard Algebraic and Transcendental functions, Derivative of composite functions, functions in parametric form, Implicit differentiation, Successive differentiation (simple cases), Leibnitz theorem, Partial differentiation, Application of Euler's theorem, Derivative as a rate measure, Increasing and decreasing functions, Maxima and Minima, Indeterminate forms, Geometrical application of derivatives such as finding tangents and normals to plane curves.

**Integral calculus**: Standard methods of integration (substitution, by parts, by partial fraction, etc), Integration of rational, irrational functions and trigonometric functions. Definite integrals and properties of definite integrals, Areas under plane curves.

**Differential equations** : Definition, order, degree of a differential equation, General and particular solution of a differential equation, Formation of a differential equation, Solution of a differential equations by method of separation of variables, Homogeneous differential equations of first order

and first degree, Linear differential equations of the form  $dy/dx + p(x)y = q(x)$ , Solutions of differential equations of the form  $d^2y/dx^2 = f(x)$

**Probability and statistics**: Average (mean, median and mode). Dispersion (standard deviation and variance), Definition of probability, Mutually exclusive events, Independent events, Compound events, Conditional probability, Addition theorem.

**Number system** : Decimal, binary, octal, hexadecimal numbers and their conversion.

#### 7.1.4 BIOLOGY (45 Questions)

##### BOTANY

**Diversity of plant life**: Five kingdom system of classification with their merits and demerits. Structure, reproduction and economic importance of Bacteria and Viruses. Life history of representative members of different plant groups: *Spirogyra*, *Saccharomyces*, *Funaria*, *Dryopteris*, *Cycas*.

**Morphology of angiosperms** : Normal and Modified roots, stems and leaves, Inflorescence, Flower and its parts, Pollination, Fertilization, Fruits.

**Taxonomy of flowering plants** : Principles and units of classification (species, genus, family) Binomial nomenclature, Studies of important families: Malvaceae, Fabaceae, Asteraceae, Brassicaceae, Liliaceae.

**Cell: Structure and function** Cell Theory, Totipotency, Prokaryotic and Eukaryotic cell, Structure of typical plant cell: Cell Wall, Cell Membrane, Cell Organelles (Plastids, mitochondria,

endoplasmic reticulum, ribosomes, Golgibodies, Lysosomes, Peroxisomes). Important compounds of cell: Structure and functions of water, aminoacids, proteins, carbohydrates and fats. Properties and chemical nature of enzymes. Mode of enzyme action.

**Continuity of life:** Cell division: Mitosis, Meiosis and their significance, Mendel's laws of inheritance: Monohybrid and Dihybrid cross, Incomplete dominance, Multipleallelism.

**Genetic material:** Structure of nucleic acids. Evidences to establish 'DNA as genetic material' (Griffith and Avery's experiment). Concept of gene, Transcription and translation in Prokaryotes. Regulation of gene expression – induction and repression.

**Recombinant DNA and Tissue culture technique:** Recombinant DNA techniques and its significance. Gene bank, Production of Transgenic plants with examples, Tissue culture technique.

**Complexities of plant life:** Meristematic and tissues, Internal structures of dicot and monocot stems, roots and Isobilateral and Dorsiventral leaves, Normal secondary growth in dicot stem.

**Processes in plants :** Diffusion, Osmosis, Plasmolysis, Imbibition, Absorption and transport of water and minerals, Transpiration and its significance, Life energy and ATP, Respiration and fermentation, Photosynthesis, Biological nitrogen fixation. Growth and development: Growth regulators – Physiological effects of Auxins, Gibberellin, Cytokinin, Ethylene and Abscissic acid. Elementary idea of photoperiodism and vernalisation. Plant movements (with special reference to geotropism and phototropism).

**Ecology :** Man and environment, Ecological adaptations (Hydrophytes and Xerophytes), plant succession (Hydrosere, Xeresere), Structure and function of Ecosystem.

**Economic Botany :** Economic importance of plants like Rice, Gram (green gram) Jute, Groundnut, Mango, Tulsi.

**Common plant diseases :** Symptoms and control measure of following plant diseases: Powdery mildew of peas, Bacterial blight of rice, Mosaic disease of Papaya.

## ZOOLOGY

**Animal world :** Definition, Scope and branches of Zoology. Characteristics of living organisms (elementary idea of metabolism, transfer of energy at molecular level, open and closed system, homeostasis, growth & reproduction, adaptation, survival and death).

**Classification** (Artificial, Natural, Phylogenetic) Two-Kingdoms & Five-Kingdoms – their merits and demerits. Species concept, binomial nomenclature, scientific names of some common animals: Fishes – Rohi, Bhakura, Mirikali, Kau. Amphibians – Frog, Toad. Reptiles – House Lizard, Garden Lizard, Crocodile, Turtle, Cobra, Krait. Birds – Fowl, Peacock, Pigeon, Crow. Mammals – Tiger, Elephant, Cat, Dog, Rabbit and Man.

**Diversity of Animal life :**

**Introductory Concept:**

- (1) Concept of body plan, symmetry, coelom, germ layers, homeothermic and poikilothermic animals.
- (2) Salient features of Non-chordate phyla with examples, General characters of chordates upto class levels with examples.

**Animal Morphology:** Morphology of Paramecium, Sycon, Hydra Planaria, Ascaris, Earthworm, Cockroach, Pila, Starfish, Amphioxus, Bony fish, Cartilaginous fish, Frog, Calotes, Pigeon & Rabbit.

**Animal Histology:** Types – Epithelial, Connective (details about blood and lymph), Muscular & Nervous – Organs and Organ Systems.

**Animal Locomotion:** Joints and Muscles in movement of man, mechanism of muscle contraction, Disorders – Arthritis and Osteoporosis.

**Animal Physiology:** Animal Nutrition – Intracellular and Intercellular digestion, Digestive system of cockroach, Digestive system and process in human (ingestion, digestion, absorption, assimilation and egestion) role of hormones in digestion, malnutrition and under-nutrition.

**Animal Respiration:** Types of respiration (cutaneous, tvacheal, branchial and pulmonary), Structure and function of respiratory system in man: Respiratory organs, mechanism of pulmonary respiration, pulmonary exchange of gas, transport of gases. Common respiratory

disorders – prevention and cure.

**Animal Circulation:** Open circulation, closed circulatory system in man, Structure of Heart, Cardiac Cycle, Arteries, Veins, Capillaries, Portal System, Coronary Circulation, Blood Pressure, Respiratory pigments, Blood groups (A B O & Rh), Blood Coagulation, Blood related disorder – Hypertension, Atherosclerosis & Arteriosclerosis, Pace maker.

**Animal Excretion:** Types of Excretion (Ammonotelism, ureotelism and uricotelism), Excretion in cockroach, Excretion in human – Structure and function of kidney, Role of liver in excretion: Ornithine Cycle. Disorders related to excretion – kidney failure, dialysis, kidney transplantation, Role of ADH.

**Control and Co-ordination:** Nervous system of cockroach, Nervous system of human – central, peripheral & autonomic, transmission of nerve impulse, reflex action, sense organs (Eye and Ear).

**Human Endocrine System:** Endocrine glands (Name, Location, Hormones and their functions), hormones as messengers and regulators, feed back controls, hormonal disorders.

**Genetics:** Mendelism, linkage and crossing over, recombination, sex chromosomes, sex determination, sex linked inheritance, chromosomal aberrations (structural).

**Animal Reproduction and Human Development:** Types of reproduction – Asexual reproduction (Binary fission, multiple fission, budding), Sexual reproduction in human – male and female reproductive system, menstrual cycle.

**Human development:** Gametogenesis (spermatogenesis, oogenesis), fertilization, development upto 3 germ layers, fate of germ layers, extraembryonic membranes, structure and function of placenta.

**Cellular growth:** Hormonal control of growth, Types of regeneration and mechanism (in Planaria), ageing (Senescence).

**Biology in Human welfare (Elementary idea):** Common problems of adolescence (drugs, alcohols and tobacco), social and moral implications, mental and addictive disorders, risk of indiscriminate use of drugs and antibiotics.

**Biotechnology:** Animal tissue culture, bio-war, biopiracy, cloning and transgenic animals. Elementary idea - organ transplantations, immunity and immune disorders, vaccines and vaccination (recent advances).

**Modern techniques in diseases diagnosis:** Basic methods of estimation of haemoglobin, sugar and urea in blood, ELISA and WIDAL tests.

Basic principles of ECG, EEG, CT SCAN, MRI, Ultra Sound and Endoscopy, DNA Finger Printing.

**Human Diseases:** Types, Causes, diagnosis, prevention and treatments – AIDS, STD, Cancer and Diabetes.