ODISHA JOINT ENTRANCE EXAMINATION (OJEE-2013)

SYLLABI FOR LATERAL ENTRY 1.1STREAM (DIPLOMA)

The syllabi given here for JEE-2013 (Lateral entry diploma holders in Engineering / Technology) is only illustrative and not exhaustive. Since JEE-2013 is conducted with a view to prepare a relative merit list only for admission, the decision of the JEE-2013 committee as regards to the scope of syllabi is final. This paper is common to all the discipline except Pharmacy.

(A) BASIC ELECTRICAL ENGINEERING (40 Questions)

Fundamentals:

Concept of Source and Load, Ohm's Law, Concept of resistance, Series and Parallel DC circuits, Kirchhoff's Laws, Faraday's Laws of Electromagnetic Induction, Fleming's Left Hand Rule and Right Hand Rule.

AC Theory:

Generation of alternating emf, Difference between DC and AC, Amplitude, Cycle, Time period, Frequency, Phase, Phase Angle, Phase Difference, Instantaneous value, RMS value, Average value, Amplitude factor and Form factor, Phasor diagram representation of AC values, AC through pure resistance, inductance and capacitance, AC through RL, RC and RLC circuits, Impedance Triangle and Power Triangle.

Generation of Electrical Power:

Principle of operation of different electrical power generating plants such as Thermal, Hydro-Electric and Nuclear power plants with their block diagrams, Concept of single phase Transformer and its application.

Conversion of Electrical Energy:

DC machine and its main parts. DC generators: Principle of operation and emf equation. DC motors: Principle of operation, classification, torque equation and applied voltage V-back emf E_b relation. Starters used for DC motors. Use of different types of DC generators and motors. Principle of operation of three-phase and single-phase induction motors. Types and use of three-phase and single-phase induction motors.

Wiring and Power billing:

Types of wiring and their comparison, Layout of household wiring (single line diagram), Basic protective devices in household wiring, Calculation of Power used in small electrical appliances and installation, Calculation of Energy consumption in small electrical installations, Earthing installation, types (Pipe and Plate earthing) and uses.

Measuring Instruments:

Introduction to measuring instruments, Expression for Torque in measuring instruments, Use of PMMC and MI type of instruments(Ammeters and Voltmeters). Connection diagram of AC/DC ammeter, voltmeter, energy meter and wattmeter for single phase electrical system only.

Storage Devices:

Introduction to storage devices and their types. Charging, Discharging and Maintenance of Lead Acid battery.

(B) MATHEMATICS (40 Questions)

Algebra: Definition of complex number, Conjugate of complex number, Modulus and amplitude of a complex number. Algebra of complex numbers. Cube root of unity and their properties, De'Moivre's theorem and its application, Permutation, Combination, Binomial Theorem for any rational index, Relationship between Binomial coefficients.

Determinant and Matrices: Properties of determinants. Crammer's Rule, Types of matrices, Transpose, Adjoint and inverse of a matrix upto third order. Solution of simultaneous equation by matrix method.

Trigonometry: Trigonometrical ratios, multiple and submultiple angles, solution of trigonometrical equations, Properties of triangles, Inverse circular function and its properties.

Analytical Geometry: Distance formula, Division formula, Area of trapezium, Area of Triangle, Equation of straight lines in different form, Distance of a point from a line, Equation of circle in different forms.

Vector Algebra: Definition, Algebra of vectors, Position Vector, Resolution of vector into components, Scalar and Vector product of two vectors and their application,

scalar triple product and its application.

Calculus: Limit and continuity of function, Derivative of standard functions, Derivative of composite functions. Differentiation of implicit functions, Differentiation of function in parametric form, Differentiation using logarithm, Differentiation of a function with respect to another function, Successive differentiation in simple cases, Maxima, minima and point of inflection, Partial derivative, Euler's theorem for homogeneous functions.

Standard methods of integration (by parts, by substitution, by partial fraction etc.). Definite integrals and their properties. Area bounded by curves.

Ordinary Differential Equation: Order and degree of differential equation, formation of differential equation. Solution of first order and first degree differential equation.

Coordinate Geometry of three Dimension: Distance and Division formulae, Direction cosine and direction ratio of a line, condition of perpendicularity and parallelism, Equation of plane under different conditions, angle between two planes, Distance of a point from a plane, General equation of a sphere, Equation of a sphere with given diameter.

Probability and Statistics: Measures of central tendency (Mean, Median, Mode), Measures of dispersion (Mean Deviation, Standard Deviation and Variance), Definition of probability, equally likely, Mutually exclusive and independent events. Addition theorem of probability.

(C) ENGINEERING MECHANICS (40 Questions)

Force and Moments

Force and its effects, Classification of forces, Principle of Transmissibility, Principle of Superposition, Action and Reaction, Tension and Compression, Free Body Diagram.

Co-planer concurrent forces: Resultant of forces, Equilibrium of forces and equilibrant, Parallelogram law of forces and determination of the resultant of two concurrent forces, Components and resolve parts of a force, Principle of resolution of a force and any number of forces, Analytical determination of resultant of number of concurrent forces, Lami's Theorem, Triangle law of forces and polygon law of forces.

Coplanar non-concurrent forces: Moment of a force, Statement and prove of Varignon's theorem, Conditions of equilibrium, Determination of resultant of two like and unlike parallel forces, Couple and its moment, Various types of supports with their reactions, Simple problems on coplanar non concurrent forces with the help of free body diagram.

Center of Gravity and Moment of Inertia

Centroid and Center of Gravity(C.G.), Expression for C.G. of straight line (uniform rod),triangle, rectangle,circular,semicircular lamina. Expression for C.G. of solids like hemisphere and cone (Expression only). Different types of engineering sections (symmetrical and non-symmetrical built up sections). Location of the C.G. of the above sections. Definition Moment of Inertia(M.I.) of plain figure as second moment of area. Perpendicular axes theorem, parallel axis theorem. M.I. of plane lamina like rectangle, triangle, circle, and semicircle (from 1^{st} principle) M.I.of different engineering sections.

Friction

Frictional force, angle of friction, limiting friction, co-efficient of friction, Laws of Static Friction. Simple problems on ladder, Body on Inclined planes with applied force parallel to the plane and horizontal, Screw Jack.

Gear Drive

Various types of gears, Gear terminology, Velocity ratio and expression for the velocity ratio for simple gears. Types of gear trains (simple and compound gear trains)

Simple Lifting Machine

Definition of a machine. Simple and compound lifting machines. Mechanical Advantage (MA), Velocity Ratio (VR) and efficiency of lifting machine. Relationship between MA, VR and efficiency. Laws of machine, Friction in machines, Friction in terms of load and friction in terms of effort. Reversible machine and self-locking machine. Condition of reversibility of a machine. Velocity Ratio and efficiency of 1st , 2nd &3rd system of pulleys; Simple and differential wheel & axle, Screw jack.

Simple Stress and Strain

Stress, strain, Tensile, compressive and shear types of stress and strain, Hooke's Law of elasticity, Poisson's ratio, Elastic limit, Elastics Constants (E, G & K) relationship between E,G &K, Stress-strain curve and salient points on stress-strain curve for ductile material. Simple problems on stress and strain in case of material with uniform cross section.

Dynamics

Kinematics and kinetics of a particle, Principle of Dynamics:-Newton's laws of motion, D'Alembert's Principle and its application. Motion of particle acted upon by a constant force. Engineering Application of Work, Power and Energy: Work done, force-displacement diagram, Work done in stretching a spring, Power, Indicated Power, Brake Power and efficiency. Kinetic and potential energy & its application, Simple Harmonic Motion (SHM) with examples. Free Vibration, amplitude, frequency and time period in SHM, Velocity and acceleration of particle executing SHM, application of SHM to engineering problems. Force, Momentum and Impulse, Conservation of energy and linear momentum, Collision of elastic bodies, Co-efficient of restitution (e), Velocity after impact. Impact of body with a fixed plane.

2. SYLLABI FOR LATERAL ENTRY STREAM (+3 Sc. / B.Sc.)

2.1. +3 Sc. / B.Sc. - MATHEMATICS (60 Questions)

Algebra : Mappings. Equivalence relations and partition. Congruence modulo n relation.

Symmetric. Skew symmetric. Hermitian and skew Hermitian matrices. Elementary operations on matrices. Inverse of a matrix. Linear independence of row and column matrices. Row rank, column rank and rank of a matrix. Equivalence of column and row ranks. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix. Applications of matrices to a system of linear (both homogenous and non-homogenous) equations. Theorems on consistency of a system of linear equations.

Definition of a group with examples and simple properties. Subgroups. Generation of groups. Cyclic groups. Coset decomposition. Lagrange's theorem and its consequences. Fermat's and Euler's theorems. Homomorphism and isomorphism. Normal subgroups. Quotient groups. The fundamental theorem of homomorphism. Permutation groups. Even and odd permutations. The alternating groups An. Cayley's theorem. Introduction to rings, subrings, integral domains and fields. Characteristic of a ring.

Differential Calculus : Definition of the limit of a function. Basic properties of limits. Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnritz theorem. Maclaurin and Taylor series expansions. Asymptotes. Curvature. Tests for concavity and convexity. Points of inflexion. Multiple points. Tracing of curves in Cartesian and polar coordinates.

Integral Calculus : Integration of irrational algebraic functions and trancscendental functions. Reduction formulae. Definite integrals. Quadrature. Rectification. Volumes and surfaces of solids of revolution.

Ordinary Differential Equations: Degree and order of a differential equation. Equations of first order and first degree. Equations in which the variables are separable. Homogeneous equations. Linear equations and equations reducible to the linear form. Exact differential equations. First order higher degree equations solvable for x,y,p. Clairaut's form and singular solutions. Geometrical meaning of a differential equation. Orthogonal trajectories. Linear differential equations with constant coefficient. Homogeneous linear ordinary differential equations.

Linear differential equations of second order. Transformation of the equation by changing the dependent variable / the independent variable. Method of variation of parameters.
Ordinary simultaneous differential equations.

Vector Analysis : Scalar and vector product of three vectors. Product of four vectors. Reciprocal Vectors. Vector differentiation. Gradient, divergence and curl . Vector integration. Theorems of Gauss, Green, Stokes and problems based on these.

Geometry : General equation of second degree. Tracing of conics. System of conics. Confocal conics. Polar equation of a conic.
The straight line and the plane, sphere, cone, cylinder.

Advanced calculus : Continuity. Sequential continuity. Properties of continuous functions. Uniform continuity. Chain rule of differentiability. Mean value theorems and their geometrical interpretations. Darboux's intermediate value theorem for derivatives. Taylor's theorem with various forms of remainders.
Limit and continuity of functions of two variables. Partial differentiation. Change of variables. Euler's theorem of homogeneous functions. Taylor's theorem for functions of two variables. Jacobians.

Envelopes. Evolutes. Maxima, minima and saddle points of functions of two variables. Lagrange's multiplier method. Indeterminate forms.
Beta and Gamma functions. Double and tripe integrals. Dirichlet's integrals. Change of order of integration in double integrals.

Definition of a sequence. Theorems of limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion. Series of non-negative terms. Comparison tests. Cauchy's integral test. Ratio tests. Raabe's, logarithmic, De Morgan and Bertrand's tests. Alternating series. Leibnitz's theorem. Absolute and conditional convergence.
Series solutions of differential equations-Power series method, Bessel, Legendre and Hypergeometric equations. Bessel, Legendre and Hypergeometric functions and their properties-convergence, recurrence and generating relations. Orthogonality of functions. Orthogonality of Bessel functions and Legendere polynomials.

Laplace Transformation : Linearity of the Laplace transformation. Existence theorem for Laplace transforms. Lapalce transforms of derivatives and integrals. Shifting theorems. Differentiation and integration of transforms. Convolution theorem. Solution of integral equation and systems of differential equation using the Laplace transformation.

Linear Algebra : Vector space, Basics, Dimensions, Linear Independence and Dependence of vectors, Linear Transformation, Rank and Nullity, Range and Kernel.

Numerical Analysis : Solution of equations: Bisection, Secant, Regula falsi, Newton's Method, Roots of Polynomials.

Interpolation: Lagrange and Hermite Interpolation, Divided Difference Interpolation, Gauss Interpolation formula, Numerical Differentiation. Numerical

Integration: Newton-Cotes formula, Gauss quadrature formula, Chebychev's Formulae.

2.2. +3 Sc. / B.Sc. PHYSICS (30 Questions)

Mechanics : laws of motion, motion in a uniform field, components of velocity and acceleration in different coordinate systems. Motion under a central force, Kepler's law, Gravitational law and field. Potential due to a spherical body, Gauss and Poisson equations for gravitational self-energy. System of particles, center of mass, equation of motion, conservation of linear and angular momenta, conservation of energy, elastic and inelastic collisions. Rigid body motion, rotational motion, moment of inertia and their products.

Oscillations : Harmonic oscillations, kinetic and potential energy, examples of simple harmonic oscillations, spring and mass system, simple and compound pendulum, torsional pendulum. Superposition of two simple harmonic motions of the same frequency along the same line, interference, superposition of two mutually perpendicular simple harmonic vibrations of the same frequency, Lissajous figures, case of different frequencies.

Motion of charged particles in electric and magnetic fields : E as an accelerating field, electron gun, case of discharge tube, linear accelerator, E as deflecting field-CRO, sensitivity.

Properties of Matter: Elasticity, small deformations, Hooke's law, elastic constants for an isotropic solid, beams supported at both the ends, cantilever, torsion of a cylinder, bending moments and shearing forces. Bernoulli's theorem, viscous fluids, streamline and turbulent flow. Poiseulle's law. Capillarity, tube of flow, Reynold's number, Stokes law. Surface tension and surface energy, molecular interpretation of surface tension, pressure across a curved liquid surface, angle of contact and wetting.

Electrostatics : Coulomb's law (in vacuum) expressed in vector forms, calculation of E for simple distributions of charge at rest, dipole and quadrupole fields Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Electric potential , E = -dV/dx, Torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss' law and its application for finding E for symmetric charge distributions, Gaussian pillbox, fields at the surface of a conductor. Screening of electric field by a conductor. Capacitors, electrostatic energy, force per unit area of the surface of a conductor in an electric field.

Electric Currents: Steady current, Current density vector J, non-steady currents and continuity equation, Kirchoff's law and analysis of multi-loop circuits, rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits, AC circuits, Complex numbers and their applications in solving AC circuit problems, complex impedance and reactance, series and parallel resonance, Q factor, power consumed by an AC circuit, power factor.

Magnetostatics : Force on a moving charge, Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, Biot and Savart's law, calculation of B in simple geometric situations, Ampere's law $\nabla . B = 0$, $\nabla \times B = \mu_0 J$, field due to a magnetic dipole.

Time Varying Fields : Electromagnetic induction, Faraday's law, electromotive force $e = \sigma . E . dr$, Integral and differential forms of Faraday's law, mutual and self inductance, transformers, energy in a static magnetic field, Maxwell's displacement current, Maxwell's equations, electromagnetic field, energy density.

Electromagnetic Waves: The wave equation satisfied by E and B, plane electromagnetic waves in vacuum, Poynting's vector.

Kinetic theory of Matter: Real gas: Van der Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves. The critical constants, distinction between gaseous and

vapour state, Joule expansion of ideal gas, and of a Van der Waals gas, Joule coefficient, estimates of J-T cooling.

Thermodynamics : Blackbody radiation: energy distribution in blackbody spectrum. Planck's quantum postulates, Planck's law. Interpretation of behaviour of specific heats of gases at low temperature.

Kinetic Theory of Gases : Maxwellian distribution of speeds in an ideal gas: distribution of speeds and of velocities, distinction between mean, rms and most probable speed values.

Physical Optics : The principle of superpositions, Interference of a light, double-slit interference, coherence requirement for the sources, optical path retardation, lateral shift of fringes, Localized fringes: thin films, Michelson interferometer, Fresnel diffraction: Fresnel half-period zones, plates, straight edge, rectilinear propagation. Fraunhofer diffraction : Diffraction of a single slit, the intensity distribution, diffraction at a circular aperture and a circular disc. Diffraction gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, polarization of transverse waves, plane, circular and elliptically polarized light. Polarization by reflection and refraction. Double reflection and optical rotation: Refraction, in uniaxial crystals, its electromagnetic theory. Phase retardation plates, double image prism, rotation of plane of polarized light, origin of optical rotation in liquids and in crystals.

Quantum Mechanics: Origin of the quantum theory: failure of classical physics to explain the phenomena such as blackbody spectrum, photoelectric effect, Ritz combination principle in spectra, stability of an atom, Planck's radiation law, Einstein's explanation of photoelectric effect, Bohr's quantization of angular momentum and its applications to hydrogen atom, limitations of Bohr's theory. Wave particle duality and uncertainty principle: de Broglie's hypothesis for matter waves, the concept of wave and group velocities, evidence for diffraction and interference of particles, experimental demonstration of matter waves. Consequence of de Broglie's concepts; quantization in hydrogen atom; quantized energy levels of a particle in a box, wave packets, Heisenberg's uncertainty relation for p and x, its extension to energy and time. Consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit, particle in a box, position of electron in a Bohr orbit. Quantum Mechanics: Schrodinger's equation. Postulatory basis of quantum mechanics, operators, expectation values, transition probabilities, applications to particle in a one dimensional box, harmonic oscillator, reflection at a step potential, transmission across a potential barrier.

Week spectra : continuous X-ray spectrum and its dependence on voltage, Characteristics X-rays. Moseley's law, Raman effect, Stokes and anti-Stocks lines, fission and fusion (concepts), energy production in stars by p-p and carbon cycles (concepts). Cyclotron.

Solid State Physics: X-ray diffraction, Bragg's law,

Magnetism: Atomic magnetic moment, magnetic susceptibility, Dia-Para, and Ferromagnetism, Ferromagnetic domains, Hysteresis.

Band Structure: Energy bands, energy gap, metals, insulators, semiconductors.

Solid State Devices: Semiconductors - Intrinsic semiconductors, electrons and holes, Fermi level. Temperature dependence of electron and hole concentrations. Doping: impurity states, n and p type semiconductors.

Semiconductor devices : p-n junction, majority and minority charge carriers, junction diode, Zener diode.

Electronics: Power supply : diode as a circuit element, load line concept, rectification, ripple factor, Zener diode, voltage stabilization, IC voltage regulation, characteristics of a transistor in CB, CE and CC mode.

Field effect transistors: JFET volt-ampere curves, biasing JFET, RC coupled amplifier, gain, frequency response, input and output impedance.

2.3 +3 Sc. / B.Sc CHEMISTRY (30 Questions)

Thermodynamics : Definition of thermodynamic terms, systems, surroundings etc. Types of systems, intensive and extensive properties, state and path functions and their differentials, thermodynamic processes, concept of heat and work. First law of thermodynamics, statement, definition of internal energy, enthalpy, heat capacity, heat capacity at constant volume, constant pressure and their relation, Joule's law, Joule-Thomson coefficient and inversion temperature, calculation of w, q, U, H, for the expansion of ideal gases under isothermal and adiabatic conditions for reversible processes, Work done in irreversible process.

Thermochemistry : standard state, standard enthalpy of formation, Hess's law of heat of summation and its application, heat of reaction at constant pressure and constant volume, enthalpy of neutralization, bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy. Kirchoff's equation.

Chemical equilibrium : Equilibrium constant and free energy. Derivation of law of mass action (Study of homogeneous and heterogeneous equilibria). Le chaterlier's principle.

Phase equilibrium: Statement and meaning of the terms - phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibrium of one component system - water and sulphur system.

Electrochemistry-I : Electrical transport-conduction in metals and in electrolyte solution, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, migration of ions and Kohlrausch law, Arrhenius theory of electrolytic dissociation and its limitations, weak and strong electrolytes, Ostawald's dilution law, its uses and limitations. Application of conductivity measurements, determination of degree of dissociation, determination of Ka of acids, Determination of solubility product of a sparingly soluble salt, conductometric titration.

Electrochemistry-II : Types of reversible electrodes- gas metal ion, meta-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrodes-reference electrodes, standard electrode potentials, sign conventions, electrochemical series and its significant, EMF of a cell and its measurements. Computation of cell EMF, concentration of cell with and without transport, liquid junction potential, definition of pH, and pKa, determination of pH using hydrogen electrode, buffers-mechanism of buffer action, Henderson equation. Hydrolysis of salts (quantitative treatment), determination of pH, Ka, Kw and Kh by emf methods.

Atomic Structure : Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation (Mathematical derivations excluded) significance of quantum numbers, shapes of s,p,d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements.

Periodic Properties : Atomic and ionic radii, ionization enthalpy and electron – gain enthalpy, electronegativity-definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

Chemical Bonding : Covalent Bond - valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion,

(VSEPR) theory of NH_3 , H_3O+, SF_4, ClF_3, ICl_2 and H_2O. MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules.

s-Block Elements : Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems,

p-Block Elements : Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16, hydrides of boron-diborane, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), basic properties of halogens, interhalogen compounds.

Chemistry of Noble Gases : Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds (fluorides and oxides), Chemistry of elements of first transition series. Characteristic properties of d-block elements.
Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Coordination Compounds : Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds (4 and 6 only) valence bond theory of transition metal complexes.

Acids and Bases : Arrhenius, Bronsted-Lowry, Lewis concepts of acids and bases.

Structure, bonding and mechanism of Organic reactions:
Inductive effect, resonance, steric effect, influence of these effects on acidity, basicity and dipolemoments, reactive intermediate-carbocations, carbanions, free-radicals and carbenes - formation, stability and structure, types and mechanism of organic reactions-SN1 , SN2, SE1, SE2 , E1, E2, AdE, AdN,
Stereochemistry of Organic compounds: Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, meso compounds, relative and absolute configuration, sequence rules, D-L, R-S, systems of nomenclature, geometric isomerism, determination of configuration of geometric isomers, E-Z system of nomenclature, conformational isomerism, conformational analysis of ethane and n-butane, conformations of cyclohexanes, axial and equatorial bonds, difference between conformation and configurations.

2.4 +3 Sc. / B.Sc. Biology (60 Questions)

2.4.1 +3 Sc. / B.Sc. BOTANY (30 Questions)
Microbes : Viruses and Bacteria : General account of viruses and bacteria – structure, nutrition, reproduction and economic importance.

Diversity of seed plants : Characterstics of seed plants; evolution of the seed habit; seed plants with (angiosperms) and without (gymnosperms) fruits. Morphology of vegetative and reproductive parts; anatomy of root, stem and leaf; Reproduction and life cycle of *Cycas, Pinus and Ephedra*. Botanical nomenclature: Principles and rules; taxonomic ranks; type concept; principle of priority. Classification of angiosperms; salient features of the systems proposed by Bentham and Hooker and Engler and Prantle. Major contributions of cytology, phytochemistry and taximetrics to taxonomy. Diversity of flowering plants as illustrated by members of the families: Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae,

Acanthaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Liliaceae and Poaceae.

Development & reproduction in flowering plants : The basic body plan of a flowering plant – modular type of growth. The shoot systems : the shoot apical meristem and its histological organization; vascularisation of primary shoot in monocotyledons and dicotyledons; formation of internodes, branching pattern; monopodial and sympodial growth; cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; secondary phloem – structure – function relationships; Leaf : origin, development, arrangement and diversity of size and shape; internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission. The root system : the root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes. Flower : a modified shoot; functions; structure of anther and pistil; the male and female gametophytes; types of pollination; pollen-pistil interaction, self incompatibility; double fertilization; formation of seed – endosperm and embryo; fruit development and maturation.

Cell Biology & Genetics : Structure and function of nucleus : Ultrastructure of nuclear membrane & nucleolus. Chromosome organization : Morphology; centromere and telomere; Chromosome alterations : deletions, duplications, translocations, inversions; Variations in chromosome number : aneuploidy, polyploidy; Sex chromosomes. DNA, the genetic materials : DNA structure; replication; DNA- protein interaction; the nucleosome model; genetic code; satellite and repetitive DNA. Cell division : mitosis; meiosis. Genetic inheritance : Mendelism Linkage analysis; Allelic and non-allelic interactions. Gene expression : Structure of gene; transfer of genetic information; transcription, translation. Genetic variation : Mutations, spontaneous and induced; transposable genetic elements; DNA damage and repair. Extranuclear genome : Presence and function of mitochorndial and plastid DNA. Structure and function of other organelles : Golgi, ER, peroxisomes, vacuoles. The cell envelopes : Plasma membrane; functions; the cell wall.

Biochemistry: Basics of enzymology: Discovery and nomenclature; characteristics of enzymes; concept of holoenzyme, coenzyme and cofactors; regulation of enzyme activity; mechanism of enzyme action. Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; Z-scheme; photophosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration. Respiration: ATP – the biological energy currency; aerobic and anaerobic respiration; Glyolysis, kreb's cycle; electron transport system and oxidative phosphorylation (chemi-osmotic theory). Nitrogen and lipid metabolism : Biology of nitrogen fixation; importance of nitrate reductase and its regulation. Structure and function of lipids; fatty acids biosynthesis; oxidation; saturated and unsaturated fatty acids; storage and mobilization of fatty acids. The concept of photoperiodism; physiology of flowering; florigen concept; Physiology of senescence, fruit ripening; Plant hormones – auxins, gibberllins, cytokinins, abscisic acid and ethylene: history of their discovery biosynthesis and mechanism of action.

Biotechnology : Functional definition; basic aspects of plant tissue culture; cellular totipotency, differentiation and morphogenesis; Genetic engineering: Tools and techniques of recombinant DNA technology; cloning vectors; genomic and c-DNA-library transposable elements;

techniques of gene mapping and chromosome walking. Biology of Agrobacterium; Vectors for gene delivery and marker genes; salient achievements in crop biotechnology.

Ecology : Plants and environment : Atmosphere (gaseous composition), water (properties of water cycle), light (global radiation, photosynthetically active radiation), temperature, soil (development, soil profiles, physico- chemical properties), and biota. Population ecology: Growth curves; ecotypes; ecads. Community ecology: Community characteristic, frequency, density, life forms, biological spectrum; ecological succession. Ecosystems : Structure; abiotic and biotic components; food chain, food web, ecological pyramids, energy flow; biogeochemical cycles of carbon, nitrogen and phosphorus. Biogeographical regions of India: Vegetation types of India: Forests and grasslands.

Economic Botany : Food plants : Rice, wheat, maize, potato, sugarcane. Fibers : Cotton and jute. Vegetable oils : Groundnut, mustard and coconut. General account of sources of firewood, timber and bamboos: Spices: General account. Medicinal plants: Beverages: (Tea and coffee), Rubber.

2.4.2 +3 Sc. / B.Sc. ZOOLOGY (30 Questions)

Diversity-I : Principles of classification – salient features and classification upto orders in non-chordates. Structural organization in different classes of non-chordates. Protozoa – Type study (paramecium), parasitic protozoans. Porifera and coelenterata – Type study (Sycon and Aurelia), Coral and coral reefs. Platyhelminthes and Nemathelminthes– Type study (Fasciola, Taenia) and parasitic adaptations. Annelida – Type study (Earthworm). Mollusca – Type study (Pila). Arthropoda – Crustacean larval forms, Type study (Prawn).

Cell Biology : Cell Theory. Structure of prokaryotic and eukaryotic cells. Cellular organelles. Role of mitochondria in cellular energy transactions. Membrane transport of small molecules. Cell signaling. Cytoskeleton. Cell cycle. The mechanics of cell division (Mitosis and Meiosis). Cell junctions, cell adhesion. Biology of cancer.

Animal Diversity-II : Origin and general characters of chordates. Protochordates – Classification upto orders, structural organization of Amphioxus, Balanoglossus and Herdmania. Agnatha – Classification upto orders. Fishes – Classification upto orders, Type study (Scoliodon). Amphibians – Origin of land vertebrates, classification upto orders, parental care. Reptiles – Classification upto orders, poisonous snakes of India. Bird migration, principles of bird flight, origin of birds. Mammals – Origin, classification and general characters. Comparative anatomy of systems (e.g. kidney, heart).

Physiology : Aim and Scope of Physiology – Cell Physiology, mammalian physiology, comparative physiology and applied physiology. Chemical foundations of physiology – solutions, osmotic pressure, diffusion, pK and pH, buffers. Biomolecules – Carbohydrates, lipids, proteins, nucleic acids. Blood – Composition and function of blood; Blood groups; Blood coagulation;. Heart – Structure; origin, conduction and regulation of heart beat;. Respiration – Mechanism and control of breathing. Digestion and absorption of dietary components. Structure and function of kidney, physiology of urine formation. Physiology of contraction of skeletal and smooth muscle. Physiology of nervous conduction. Endocrine glands (Pituitary, Thyroid). Nature of enzymes.

Vertebrate Endocrinology and Reproductive Biology : Classification of hormones. Hormonal regulation of physiological processes – basic concepts. Hormones and human health – production of hormones as pharmaceuticals.

Reproductive cycles in vertebrates. Fertilization in vivo and in vitro. Embryo transfer technology. Sex determination and sex differentiation. Endocrine disorders – brief description.

Evolution & Behaviour : Concept of Evolution. Origin of life on Earth. Origin of prokaryotic and eukaryotic cells. Variations, mutations, recombination, Isolation, Natural selection. Concept of species and speciation. Mimicry. Population genetics, Genetic drift, Hardy-Weinberg Law. Evolution of Man. Introduction to Ethology – animal sense organs. Patterns of behaviour. Reproductive behavioural patterns. Social organization in animals, social interactions among individuals. Learning behaviour in animals. Drugs and behaviour.

3 SYLLABI FOR LATERAL ENTRY (PHARMACY)

3.1 PAPER for Pharmacy (120 Questions)

The course content is same as the syllabus of part-I and part-II of Diploma in Pharmacy as per the Education Regulation – 1991 of Pharmacy Council of India.