

PLANT TAXONOMY

Scheme of examination:

MM: 35

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT - I

Introduction, Principles of Taxonomy, Units of Classification, Concept of Genus and Species. Binomial Nomenclature, International Code of Botanical Nomenclature. Taxonomic Literature; Botanical Gardens and Herbaria.

UNIT - II

Development of Taxonomy and History of Different System of Classification. Bentham and Hooker's System of Classification. Engler and Prantle System of Classification. Evolutionary Trends in Angiosperms. Primitive and Advanced Characters.

UNIT - III

Diversity of flowering plants as illustrated by members of the families and economic importance of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Rubiaceae, Asteraceae.

UNIT - IV

Diversity of flowering plants as illustrated by members of the families and economic importance of the following families: Apocynaceae,

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Asclepiadaceae, Convolvulaceae, Solanaceae Acanthaceae, Lamiaceae,
Euphorbiaceae, Liliaceae and Poaceae.

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भारतीय विज्ञान संस्थान
बसन्तपुरी, कोलकाता-७०००३२
पुस्तकालय, कोलकाता

EMBRYOLOGY AND ECONOMIC BOTANY

Scheme of examination:

MM: 35

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2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Ontogeny of the flower parts- development and variations. Structure of anther, microsporogenesis, Tapetum- types and function ,development of male gametophyte, structure of pollen grains.

Types of ovule, Megasporogenesis, development of female gametophyte(Embryosac) . Pollination,Pollination types. Fertilization, double fertilization, significance of double fertilization.

UNIT - II

Development of Dicot and monocot embryo, Formation of embryo, Types of embryo. Endosperm, Types of endosperm, Endosperm haustoria. . Polyembryony, Induced polyembryony. Parthenocarpy, Apomixis and adventive embryony.

UNIT - III

Basic concept of center of origin of cultivated plants. Food plants- rice, wheat, maize, potato, sugarcane. Vegetables: General account with a note on radish, onion, garlic, cabbage, spinach, cauliflower, cucumber, tomato, lady finger and pea. Fruits: General account with a note on apple, banana,

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ber, mango, mulberry, jamun, watermelon, muskmelon, guava and orange.

Vegetable oil: groundnut, mustard and coconut.

UNIT - IV

Spices: General account with an emphasis on those cultivated in

Rajasthan: (Cumin, Capsicum, Coriander). Beverages: Tea and coffee.

Medicinal plants: General account with an emphasis on plant species

cultivated in Rajasthan (Senna, Isabgol, Safed musli). Fibers: Cotton and

jute. Wood: General account of sources of firewood, timber and bamboos;

Rubber. Ethnobotany: a general account.

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वनसंरक्षण विभाग
राजस्थान सरकार, जयपुर

MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

Scheme of examination:

MM: 35

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

Unit – 1

History of molecular biology: work of Chargaff, Watson and Crick model of DNA, Meselson and Stahl replication experiment ; Hershey and Chase experiment, Chromatin structure and gene expression, S. Benzer and gene concept. Kary Mullis and Polymerase chain reaction, Application of PCR technique, an overview of DNA fingerprinting and its use.

Unit-2

Central dogma , Reverse transcriptase and its application, Transcription in eukaryotes, RNA processing, capping, splicing and polyadenylation, Translation, initiation, elongation and termination. Jacob-Monod and Lac operon, Negative and positive control, attenuation and antitermination, structure of promoter.

Unit-3

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PLANT ECOLOGY

Scheme of examination:

MM: 35

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT – I

Plants and Environment: Atmosphere (gaseous composition and properties of four distinct zone viz. stratosphere, troposphere, mesosphere and thermosphere): water (distribution in biosphere and properties of water cycle): Morphological, anatomical and physiological responses of plants to water (Hydrophytes and Xerophytes). Light: global radiation, photosynthetically active radiation.

UNIT II

Zonation in water body: littoral, limnetic and profundal zones; photoperiodism, heliophytes and sciophytes, Temperature (Raunkier's classification of plants: megatherm, mesotherm, microtherm, heikistotherm; themoperiodicity and vernalisation). Soil (soil profile, development - weathering and maturation. Soil texture, soil types, role of pH, organic matter, soil water, soil nutrients. Interactions among organisms (neutralism, amensalism, allelopathy, competition, predation, parasitism, protocoooperation, mutuallism).

UNIT III

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Population, Community, Ecosystem and Phytogeography: Population ecotypes, ecades. Community characteristics: stratification, life forms and biological spectrum, frequency density and cover. Ecological succession: types (primary and secondary), mechanism: nudation, migration, ecesis, reaction and climax; xerosere, hydrosere.

UNIT IV

Ecosystems: Structure-abiotic and biotic components, trophic level, food chain, food web, ecological pyramids, energy flow (Box and Pipe model of Odum). Biogeochemical cycles of carbon and phosphorus; Vegetation types of India.



ABSTRACT ALGEBRA

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Definition and simple properties of Groups and Subgroups. Cyclic group.

UNIT – II

Permutation Groups. Cosets, Lagrange's theorem on the order of subgroups of a finite order group.

UNIT – III

Morphism of groups, Cayley's theorem. Normal subgroups and Quotient groups. Fundamental theorems of Isomorphism.

UNIT – IV

Definition and simple properties of Rings. Integral domain and field, Characteristics of a Ring and Field.

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COMPLEX ANALYSIS - I

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Complex plane, connected and Compact sets. Curves and Regions in complex plane. Jordan curve Theorem (Statement only). Extended complex plane. Stereographic projection.

UNIT – II

Complex valued function - Limits, Continuity and Differentiability. Analytic function, Cauchy- Riemann equations (cartesian and polar form). Harmonic functions, Construction of an analytic function.

UNIT – III

Complex integration, Complex line integrals, Cauchy integral theorem, Indefinite integral, Fundamental theorem of integral calculus for complex functions. Power series - Absolute convergence, Abel's theorem, Cauchy-Hadamard theorem, Circle and Radius of convergence, Analyticity of the sum function of a power series.

UNIT – IV

Cauchy integral formula, Analyticity of the derivative of an analytic function, Morera's theorem, Poisson integral formula Liouville' theorem. Taylor's theorem. Laurent's theorem. Maximum modulus theorem.

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DYNAMICS AND COMPUTER PROGRAMMING IN 'C'

Scheme of examination:

MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Velocity and Acceleration – along radial and transverse directions, along tangential and normal directions.

UNIT – II

S.H.M. Hooke's law motion along horizontal and vertical elastic strings.

UNIT – III

Motion in resisting medium-Resistance varies as velocity and square of velocity.

UNIT – IV

Programming languages and problems solving on computers, Algorithm, Flow chart, Programming in C-constants, Variables, Arithmetic and logical expressions, input-output conditional statements, Implementing loops in Programs, Defining and manipulation arrays and functions.

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LINEAR ALGEBRA

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Subrings. Morphism of rings. Ideals and Quotient Ring. Maximal ideal and Prime ideal. Principal Ideal domain. Field of quotients of an integral domain. Prime fields.

UNIT II

Definition, Examples and Simple properties of Vector spaces and Subspaces.

UNIT III

Linear combination, Linear dependence and Linear independence of vectors. Linear span, Direct sum and Complement of subspaces. Generation of subspaces, sum of subspaces.

UNIT IV

Basis and Dimension. Quotient space and its dimension.

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COMPLEX ANALYSIS - II

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Singularities of an analytic function, Branch point, Meromorphic and Entire functions, Riemann's theorem, Casorati-Weierstrass theorem.

UNIT II

Residue at a singularity, Cauchy's residue theorem. Argument principle. Rouché's theorem. Fundamental theorem of Algebra.

UNIT III

Conformal mapping. Bilinear transformation and its properties.

Elementary mappings: $w(z) = 1/z, (z+1/z), z^2, e^z, \sin z, \cos z,$ and $\log z$.

UNIT IV

Evaluation of a real definite integral by contour integration. Analytic continuation. Power series method of analytic continuation.

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ADVANCED DYNAMICS

Scheme of examination: MM: 22

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Work and energy; Cycloidal Motion

UNIT – II

Motion on a smooth curve in a vertical plane. Motion on the inside and outside of a smooth vertical circles

UNIT – III

Central orbits p-r equations. Apses. Time in an orbit. Kepler's laws of planetary motion.

UNIT – IV

Moments of inertia- M.I. of rods . circular rings, circular disks, solid and hollow spheres, Rectangular lamina, Ellipse and Triangle, Theorem of parallel axis, Product of inertia.

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MATHEMATICAL PHYSICS - I

Scheme of examination:

MM: 23

- 1. In all five questions are to be answered. There shall be two questions from each unit. A student has to answer one question from each unit. Fifth question will be compulsory and will cover the entire syllabus.*

UNIT-I

Orthogonal curvilinear coordinate system:

Orthogonal curvilinear coordinate system, scale factors, expression for gradient, divergence, curl and their application to cartesian, circular cylindrical and spherical polar coordinate.

UNIT-II

Tensors:

Coordinate transformation and Jacobian, transformation of covariant, contra variant and mixed tensor, Addition, subtraction, multiplication and contraction of tensors, Metric tensor and its use in transformation of tensors. Dirac delta function and its properties.

UNIT-III

Four Vectors

Four vector formulation, energy momentum four vector, relativistic equation of motion, invariance of rest mass and orthogonality of four force and four velocity, Lorentz force as an example of four force, transformation of four frequency vector, longitudinal and transverse Doppler's effect.

UNIT-IV

Relativistic Dynamics:

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Transformation between laboratory and center of mass system. four momentum conservation. kinematics of decay products of unstable particles and reaction thresholds: Pair production, inelastic collision of two particles, Compton effect. Lorentz transformation and rotation in space-time, time like and space like vectors, world line, macro-causality.

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ELEMENTARY QUANTUM MECHANICS AND SPECTROSCOPY - I

Scheme of examination:

MM: 23

- 1. In all five questions are to be answered. There shall be two questions from each unit. A student has to answer one question from each unit. Fifth question will be compulsory and will cover the entire syllabus.*

UNIT-I

Development of quantum Mechanics:

Historical development and experimental evidence for quantum theory. black body radiation. Planck's radiation law, photoelectric Effect, Compton effect. De-Broglie relation, Davisson- Germer Experiment; Uncertainty principle, its application such as (i) Non-existence of electrons in nucleus, (ii) Ground State energy of H - atom. (iii) Ground state energy of harmonic oscillator, (iv) Natural width of spectral lines.

UNIT-II

Schrodinger equation:

Its need and justification. time dependent and time independent forms. physical significance of the wave function and its interpretation. Probability, current density, Wave packet, group and phase velocities, principles of superposition, diffraction at a single slit.

UNIT-III

Operators in quantum mechanics:

definition of an operator, Algebra of operator linear and commutator operators, Eigen values and Eigen functions, Operators for momentum, K.E, Hamiltonian, total energy and angular momentum, fundamental postulates of quantum mechanics, Hermitian operator, orthogonality,



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Degeneracy and commutation relations, Ehrenfest's theorem, Bohr's principle of complementarity, principle of superposition.

UNIT-IV

Applications of Quantum theory to atomic spectra:

Quantum features of spectra of one electron atoms; Frank Hertz experiment and discrete energy states, Schrodinger's equation for a spherically symmetric potential. Schrodinger's equation for one electron atom in spherical coordinates, Separation of variables.

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NUCLEAR AND PARTICLE PHYSICS

Scheme of examination:

MM: 24

- 1. In all five questions are to be answered. There shall be two questions from each unit. A student has to answer one question from each unit. Fifth question will be compulsory and will cover the entire syllabus.*

UNIT-I

Nuclear structure and properties:

Constituents of nucleus, properties of nuclear forces, binding, energy, semi empirical mass formula, mass defect and packing fraction, saturation characteristics; Magnetic dipole moment and electric quadruple moment, angular momentum and parity; Variation of size of nucleus with mass number; Stable nucleus and conditions for stability (e.g. beta emissions for different isobars).

UNIT-II

Nuclear Fission and Fusion:

Energy released in fission, Theory of nuclear fission and liquid drop model, Barrier penetration – Theory of spontaneous fission, Nuclear chain reaction, condition of controlled chain reaction, Principle of nuclear reactors, classification of reactors. Energy released in fusion, fusion reactions in stars. carbon and pp cycle.

UNIT-III

Accelerators and Detectors:

Need for accelerators, Ion sources, Drift tube, linear accelerator, cyclotron, synchrocyclotron, Betatron, electron synchrotron, proton synchrotron.

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Ionization chamber, Proportional Counter, Geiger Muller Counter,
Scintillation counter.

UNIT-IV

Elementary Particle:

Properties of particles. Classification into leptons, mesons and baryons,
Matter and antimatter, Conservation laws: (Qualitative discussion) of
isospins, strangeness, charge conjugation and parity, Fundamental quark
structure of particles.

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MATHEMATICAL PHYSICS - II

Scheme of examination:

MM: 23

- 1. In all five questions are to be answered. There shall be two questions from each unit. A student has to answer one question from each unit. Fifth question will be compulsory and will cover the entire syllabus.*

UNIT-I

Relativistic Electrodynamics:

Law of conservation of charge and equation of continuity. Lorentz transformation of charge and current densities, Lorentz transformation of four potentials, Lorentz transformation of an electric field and magnetic field. Description of Maxwell's equation in tensor form.

UNIT-II

Differential equations of second order and special functions – I:

Linear differential equation with variable coefficient and singular points, series solution method and its application to the Legendre's differential equations, Rodrigue's formula, Integral properties of Legendre's polynomials, generating functions of $P_n(x)$, Recurrence relations of $P_n(x)$, Associated Legendre's polynomials graphical representations.

UNIT-III

Differential equations of second order and special functions – II:

Hermite differential equation, generating functions of $H_n(x)$, Recurrence relations of $H_n(x)$, Orthogonality relation for Hermite equation, Laguerre differential equation, generating functions of Laguerre polynomials, Recurrence relations of $L_n(x)$, Rodrigue's formula for $L_n(x)$, Orthogonality relation for Laguerre polynomials. Associated Laguerre equations.

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UNIT-IV

Boundary value problems:

Techniques of separation of variables and its application to the following boundary value problems (i) Laplace's equation in three dimensional Cartesian coordinate system – line charge between two earthed parallel plates, (ii) Helmholtz equation in circular cylindrical coordinates- Cylindrical resonant cavity, (iii) Wave equation in spherical polar coordinates-the vibration of a circular membrane, (iv) Diffusion equation in two dimensional Cartesian coordinate system-heat conduction in a thin rectangular plate, (v) Laplace's equation in spherical coordinate system-electric potential around a spherical surface.

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ELEMENTARY QUANTUM MECHANICS AND SPECTROSCOPY - II

Scheme of examination:

MM: 23

- 1. In all five questions are to be answered. There shall be two questions from each unit. A student has to answer one question from each unit. Fifth question will be compulsory and will cover the entire syllabus.*

UNIT-I

Simple solution of Schrodinger's equation:

Time independent Schrodinger equation and stationary state solution, boundary and continuity conditions, particle in one dimensional box, eigen function and eigen values, discrete energy levels, generalisation to three dimensions and degeneracy of levels.

UNIT-II

Boundary Value Problems:

Potential steps and rectangular potential barrier, calculation of reflection and transmission coefficients, qualitative discussion of application to alpha-decay; Square well potential problem, reflection and transmission coefficient, and resonant scattering; Particle in one dimensional infinite potential well and finite potential well, energy eigen values and eigen functions, transcendental equation and its solution.

UNIT-III

Simple harmonic oscillator:

Simple harmonic oscillator (one dimensional case) Schrodinger equation and its solution, eigen function, energy eigen values, zero point energy;

Parity-symmetric and anti-symmetric wave functions with graphical representation; Expectation values of x , x^2 , Px , P^2x and T for one

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dimensional SHO in ground state. Orthogonality of Eigen functions for one dimensional SHO.

UNIT-IV

Orbital Angular Momentum and Spin:

Orbital angular momentum and quantisation, spherical harmonics, energy levels of H-atom, shapes of $n=1$, and $n=2$ wave functions, average value of radius of H-atom, comparison with Bohr model and Bohr correspondence principle, Stern-Gerlach experiment, spin and magnetic moment, spin orbit coupling and qualitative explanation of the fine structure; Atoms in a magnetic field, Zeeman splitting.

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SOLID STATE PHYSICS

Scheme of examination:

MM: 24

- 1. In all five questions are to be answered. There shall be two questions from each unit. A student has to answer one question from each unit. Fifth question will be compulsory and will cover the entire syllabus.*

UNIT-I

Crystal structure and Crystal Differection:

Various types of binding; Cohesive energy and compressibility of ionic crystals; lattice basis, lattice translation vector, Miller indices, simple crystal structures-SC, FCC, BCC and HCP, packing fraction, volume of unit cell. Bragg's Law, X – ray and neutron differection Rotating crystal method, Laue method and powder method.

UNIT-II

Electrical properties:

Equilibrium state of electron gas in a conductor in the absence of electric field, electron drift in an electric field, relaxation time and mean free path; Electrical conductivity of electron gas, Wiedemann- Franz-Lorentz law, temperature dependent electrical conductivity of metals, mobility and drift motion.

UNIT-III

Magnetic Properties:

Classification of magnetic materials, diamagnetism, paramagnetism due to free ions and conduction electrons, Curie law. Ferromagnetism, nature and origin of Wiess molecular field, Domains, Hysteresis loop, Outline of antiferromagnetism and ferrimagnetism, ferrites.

UNIT-IV

Thermal Properties and Superconductivity:

Normal modes spectrum of a lattice, spectral distribution function, concept of phonons, Debye model for the heat capacity of solids, contribution from electron gas in metals, Zero resistivity, critical temperature, critical magnetic field, Meissner effect. Type-I and Type-II superconductors, BCS theory (Basic idea). High Tc superconductors .

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CHORDATES

Scheme of examination:

MM: 35

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Classification and characters of phylum Chordata (excluding extinct forms) up to orders (up to subclass in mammals).

Habit, habitat and Salient features of Herdmania, Branchiostoma and Petromyzon :

Ascidian tadpole larva and its metamorphosis
Ammocoete larva.

UNIT - II

Comparative Anatomy (with special reference to Scoliodon, Frog, Varanus, Columba and Rabbit)-

Integument - skin structure and development of placoid scales, feathers and hair.

Basic plan of vartebrate endoskeleton
Alimentary canal

UNIT - III

Comparative Anatomy (with special reference to Scoliodon, Frog, Varanus, Columba and Rabbit)-

Origin and evolution of Heart and aortic arches.
Respiratory system.

UNIT - IV

Comparative Anatomy (with special reference to Scoliodon, Frog, Varanus, Columba and Rabbit)-

Brain
Urinogenital system.

UNIT - V

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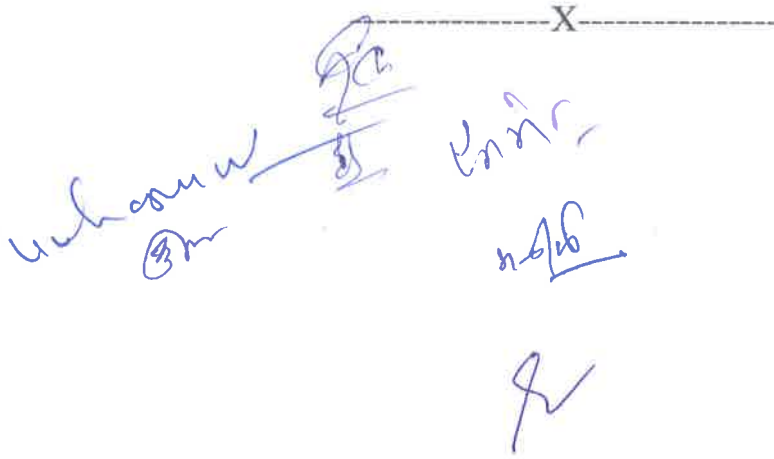
Pisces – Types of scales and fins, Migration Parental care.

Amphibia - Parental care.

Reptilia - Poisonous and non-poisonous snakes,

Aves - Flight adaptation, Bird migration.

Mammals - Dentition.



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DEVELOPMENTAL BIOLOGY

Scheme of examination:

MM: 35

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT - I

Historical review: types & scope of embryology

Gametogenesis: Spermatogenesis and oogenesis

Fertilization mechanism & its significance, Parthenogenesis

UNIT - II

Types of eggs

Planes and patterns of cleavage

morulation and blastulation

gastrulation - Fate maps, morphogenetic cell movements, significance.

UNIT - III

Development of chick up to 4 – somite stage.

Extra-embryonic membranes in chick.

Mammalian placentation - types, classification & functions.

UNIT - IV

Embryonic induction; primary organizer, differentiation, competence;

Regeneration in vertebrates

Apoptosis

UNIT - V

Metemorphosis in Frog & Insects.

Teratological effects of Xenobiotics.

Embryonic stem cells, Brief idea on cloning.

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Brief account of biology of aging.

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- 'B/L' below 'u'
- 'R' below 'u'
- 'Emi' below 'u'
- 'nAb' below 'u'
- 'AB' below 'u'

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EVOLUTION AND ETHOLOGY

Scheme of examination:

MM: 35

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Chemical origin of Life.

Lamarckism & Darwinism.

Natural selection (Differential reproduction).

Genetic basis of evolution.

UNIT II

Variation and Speciation.

Isolation

Adaptations.

Palaeontology: fossils: Geological division of the Earth crust: imperfection of fossil record.

UNIT III

Zoogeographical distribution: Principal zoogeographical regions of the world with reference to their mammalian fauna.

Continental drift.

Study of Extinct forms: Dinosaurs, Archaeopteryx

UNIT IV

Introduction of Ethology.

Concept of Ethology: Fixed action pattern, Sign stimulus, Innate releasing mechanism, Action specific energy, motivation, imprinting & learning.

Methods of studying brain behaviour: Neuroanatomical, neurophysiological,

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neurochemical techniques

UNIT V

Pheromones and behaviour.

Hormones and behaviour.

**Societies: Characteristics & advantages with special reference to Honey Bee,
Deer & Monkey.**

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ECOLOGY AND BIOSTATISTICS

Scheme of examination:

MM: 35

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Basic concepts of ecology & limiting factors.

Biotic and Abiotic Factors.

Ecosystem- Components of ecosystem, energy flow, ecological pyramids, Food chain, Food web

UNIT II

Biogeochemical cycles (O₂, CO₂, H₂O, N and P).

Populations- Characteristics, Growth and its analysis.

Intraspecific & interspecific: Commensalism & Mutualism.

Community ecology: Characteristics & structure, Ecotone, Edge effect

UNIT III

Ecological Succession (Xerosere and Hydrosere).

Major Biome.

Habitat Ecology-Aquatic, Marine, Terrestrial - Desert, Forest.

UNIT IV

Conservation and management of natural resources.

Pollution.

Green house effect, El-Nino and La-Nino effects.

Wild life conservation and management.

Biodiversity of Rajasthan, Concept of threatened species.

UNIT V

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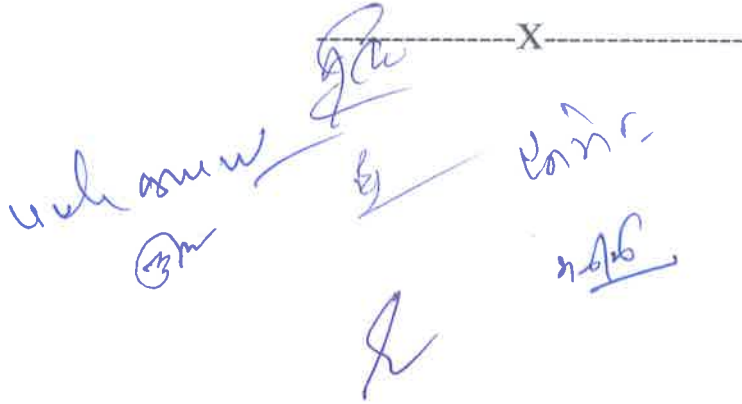
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Introduction, scope and application of Biostatistics.

Frequency distribution, Graphical presentation of data.

Mean, mode, median and their significance.

Standard deviation and standard error.



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Inorganic Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Metal-Ligand Bonding: Limitations of crystal field theory, molecular orbital theory of octahedral, tetrahedral and square planar complexes, π -bonding and molecular orbital theory.

UNIT – II

Organometallic Compounds: Definition and classification of organometallic compounds, synthesis, properties and structures of organometallic compounds of magnesium, aluminium, tin and lead.

UNIT – III

Inorganic Polymers - I: Type of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones, phosphonitric halides and condensed phosphates.

UNIT – IV

Nuclear Chemistry - I: Fundamental particles of nucleus (nucleons), concept of nuclides. Representation of nuclides, isotopes, isobars and isotones with specific examples. Applications of radioisotopes, size concept in nucleus and atom. Qualitative idea of the stability of nucleus (n/p ratio).

UNIT – V

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Bioinorganic Chemistry – I : Role of bulk and trace metal ions in biological systems with special reference to Na,K,Mg,Ca,Fe,Cu and Zn.
Chlorophylls and their role in photosynthesis.

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Organic Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Heterocyclic Compounds: Nomenclature, Five and six membered heterocyclic compounds, Aromatic Character, preparation, reactions, chemical reactivity, orientation (Electrophilic and nucleophilic substitution reaction), basicity of pyrrole, furan, thiophene and pyridine. Condensed five and six membered heterocycles, structure, preparation and reactions of indole, quinoline and isoquinoline.

UNIT – II

Polymers and Polymerization: Addition and condensation polymerization, their mechanism, copolymerization, coordination polymerization, Ziegler-Natta catalyst, plastics, thermoplastic and thermosetting resins, plasticizers, polystyrene, PVC, polyacrylates, polyacrylonitrile, Dacron, terylene, nylon-66, bakelite, melamine and polyurethanes. Elementary idea of the stereochemistry of polymers. Synthetic and natural rubber.

UNIT – III

Amino Acids: Classification, structure and stereochemistry of amino acids. Physical properties, zwitter ion structure, isoelectric point and electrophoresis. Preparation and reaction of α -amino acids.

UNIT – IV

Carbohydrates: Introduction, classification, constitution and reaction of glucose and fructose, mutarotation and its mechanism, cyclic structure, pyranose and furanose forms, Haworth projection formulae, configuration



of monosaccharides, determination of ring size, conformational analysis of monosaccharides, Epimerization, chain lengthening and chain shortening in aldoses. Interconversion of aldoses and ketoses.

Disaccharides: Structure determinations of maltose, lactose and sucrose.

Polysaccharides: Structure of starch and cellulose.

UNIT – V

Organosulphur Compounds: Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides.

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Physical Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Quantum Mechanics: Schrodinger's wave equation for particle in three dimensional box, H-atom, quantum no. and their importance, hydrogen like wave functions, radial wave function's angular wave functions.

M.O. Theory, basic ideas-criteria for forming M.O. from A.O.

construction of M.O's by LCAO – H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ , σ^* and Π , Π^* orbitals and their characteristics.

Hybrid orbitals SP , SP^2 , SP^3 , Calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H_2 , comparison of M.O. and V.B. model.

UNIT – II

Photochemistry: Introduction of radiation with matter, difference between thermal and photochemical processes, laws of photochemistry: Grothus – Dropper law, stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of the fluorescence, phosphorescence, non radioactive processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple example).

UNIT – III

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Physical properties and molecular structure: Optical activity, polarization (Clausius Mossotti equation), orientation of dipole in the electric field, dipole moment, induced dipole moment, measurement of dipole moment temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties paramagnetism, diamagnetism and ferromagnetism.

UNIT – IV

Chemical Kinetics : Catalysis:- The simple catalysis mechanism $S+C \rightarrow SC \rightarrow P + C$. Its mathematical treatment and its consequences. Specific and general acid base catalysis, Enzyme catalysis, Surface catalysis and Langmuir Adsorption Isotherm, Mechanism of surface catalysis.

UNIT – V

Macromolecules :- Linear, Branched, network and homopolymer. Polymer Classification – Condensation polymers and addition polymers, number average and weight average, molecular weight, Determination methods of polymers by (I) Osmotic pressure (II) Viscosity (III) Light scattering. Properties of macromolecules.

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Analytical Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Electrogravimetry – I: Theory, electrode reactions, over potential, completeness of deposition, electrolytic separation of metals, character of the deposit, electrolytic separation of metals with controlled cathode potential.

UNIT – II

(A) Electrogravimetry – II: Electrolytic determinations at constant current-Copper and Lead. Electrolytic determinations with controlled cathode potential antimony, copper, lead and tin in an alloy.

(B) Coulometry: Coulometry at controlled potential, separation of Ni & Co by coulometric analysis at controlled potential, coulometry at constant current, coulometry titrations.

UNIT – III

Polarography: Principle and experimental set-up. Diffusion current and Half wave potential – Qualitative and quantitative applications of polarography in analytical chemistry.

- (i) wave height concentration graph.
- (ii) Internal standard (piloton method)
- (iii) Standard addition method

Use of polarography in :

- (i) Zn and Cu in brass
- (ii) Dissolved oxygen in sample.

UNIT – IV

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(A) Amperometry : Amperometric titrations, technique of amperometric titrations with the dropping mercury electrode, titration with the rotating platinum micro electrode, biamperometric titrations.

(B) Modified Voltammetric methods: Current sampled (TAST) Polarography, pulse polarography, Differential pulse polarography, Cyclic Voltammetry, Sinusoidal Alternating current polarography, Stripping Voltammetry.

UNIT – V

Mass spectrometry : Instrumentation & technique, Elementary idea about electron impact, chemical ionization and matrix assisted laser desorption ionization (MALDI), mass spectrometer techniques. Principle of Fragmentation, Molecular ion peak, base peak isotopic peaks and metastable ion peak. Determination of molecular formula, mass spectra of alkanes, alkenes, alkynes, cycloalkanes and arenes, alcohols and ethers, aldehydes and ketones.

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Inorganic Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Metal carbonyls: Preparation, properties and bonding of transition metal carbonyls. Detailed study of mononuclear and polynuclear carbonyls.

UNIT II

Inorganic Polymers-II: Metal Clusters: Higher boranes, carboranes, mettaloboranes and mettalocarboranes, metal carbonyl and halide clusters, compounds with metal - metal multiple bonds.

UNIT III

Nuclear Chemistry-II: Shell and liquid drop model, Natural and artificial radioactivity, disintegration series, disintegration rates, half life, average life, nuclear binding energy, Mass defects, Einstein's mass energy relations, Artificial transmutation, Nuclear reactions, spallations, Nuclear fission & Fusion. Nuclear reactors. Hazards of radioactive emanations.

UNIT IV

Bioniorganic Chemistry-II: Metalloporphyrins: Hemoglobin and Myoglobin and their role as oxygen carriers. Cytochrome-c.

UNIT V

Nitrogen fixation: Mechanism, Nitrogenase enzymes, dinitrogen complexes as models for nitrogen fixation.

Metalloenzymes: General discussion of enzymes, functions of metal ions, inhibition (explanation based on coordination elemistry),

Carboxypetidase-A.

Organic Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Polynuclear Compounds: Structure of naphthalene, mechanism and orientation of electrophilic substitution in naphthalene, preparation and properties of naphthalene and anthracene, some important derivatives of naphthalene like naphthols and naphthylamines. Preparation and reaction of diphenyl, diphenylmethane and triphenylmethane.

UNIT- II

Synthetic Dyes: Color and constitution (electronic concept).

Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, phenolphthalein, Fluorescein, Alozarin and Indigo.

Drugs: Chemotherapy, Synthetic uses and side effect of:

Analgesics- Aspirin, Phenacetin, Paracetamol.

Antimalarials – Chloroquine, Plasmoquine.

Antibiotics- Chloramphenicol (Chloromycetin)

Sulpha drugs and their mechanism of action. Synthesis of sulphadiazine, sulphapyridine, sulphathiazole, sulphaguanidine and sulphamethazole.

UNIT- III

Peptides and Proteins: Structure and nomenclature of peptides and proteins. Classification of proteins, peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide

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synthesis, solid-phase peptide synthesis. Structure of peptides and proteins. Levels of protein structure. Protein denaturation / renaturation.

Nucleic Acids: Introduction, constituents of nucleic acids (RNA and DNA) Ribonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT- IV

Mass Spectroscopy: Introduction, instrumentation, factors affecting fragmentation, ion analysis, ion abundance, fragmentation modes, mass spectral fragmentation of simple organic compounds – alkanes, primary alcohols, aliphatic ketones, aldehydes and carboxylic acids, Types of peak: molecular ion peak, isotopic peak, base peak, metastable peak, doubly charged ion, Mc Lafferty rearrangement, retro Diels-Alder fragmentation, Nitrogen rule.

UNIT- V

Organometallic Compounds: Organomagnesium compounds: The Grignard reagents-formation, structure and chemical reactions.

Organozinc Compounds: Formation and chemical reactions.

Organolithium Compounds: Formation and chemical reactions.

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Dr. S. S. S. S.
Dr. S. S. S. S.

Physical Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Electrochemistry-I: Types of reversible electrodes- Gas-metal ion, metal-metal ion, metal insoluble salt anion, and redox electrodes, Electrode reactions, Nernst's equation, derivation of cell E.M.F and single electrode potential. Standard hydrogen electrode, reference electrode, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells- Reversible and irreversible cells, conventional representation of electrochemical cells. E.M.F. of cell and its measurements. Computation of cell e.m.f. Calculation of thermodynamic quantities of cell reaction(ΔG , ΔH and k).

UNIT- II

Electrochemistry-II: Polarization, Overpotential and Over Voltage, Structure of double layer, theories by Helmholtz, Guoy-Chapman and Stern. Concentration cells with and without transport, Liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations. Determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods. Introduction of Polarographic technique. Classification of electrochemical cells, Requirement of power source, Lead storage cell and fuel cell.

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Corrosion- Types, Theories and methods of combating it.

UNIT- III

Phase Equilibrium-I: Solid Solutions:- Compound formation with congruent M.Pt.(Mg-Zn) and Benzophenone – dimethylamine incongruent M.Pt NaCl-H₂O, Picric acid & Benzene, FeCl₃-H₂O and CuSO₄-H₂O system.

Liquid – Liquid Mixtures – Ideal liquid mixtures, Rault's law and Henry's law, non ideal system, Azeotropes – HCl-H₂O and Ethanol-Water system.

Partially miscible liquids-pheno-Water, Trimethylamine-Water, Nicotine-Water system, Lower and upper consolute temperature, Effect of impurities on consolute temperature.

Immiscible liquids- steam distillation.

UNIT- IV

Phase Equilibrium-II: Surface Phenomena, Micelles: Surface active agents, classification of surface active agents, micellization, hydrophilic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization. Phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

UNIT- V

Adsorption: Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (Electro kinetic phenomenon), catalytic activity at surfaces, Electrode/electrolyte interface.

Analytical Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Gas Chromatography & HPLC: Introduction, gas chromatographs, detectors, programmed temperature gas chromatography, quantitative analysis by GLC, gas – solid chromatography.

High performances liquid chromatographic methods - Adsorption Chromatography. Liquid – liquid partition chromatography, Ion exchange, HPLC, exclusion chromatography.

UNIT- II

Diffraction Pattern-I: Fundamental principles, instrumentation, use of X-ray, electron and neutron in diffractometry and applications of X-ray. Application of X-ray in C.T. Scan.

UNIT- III

Diffraction Pattern-II: Electron and neutron diffractometry in biological and as analytical techniques.

UNIT- IV

Automated Methods of analysis: Automatic instruments and automation. Automation of sampling and preliminary treatment for air, water and soil, continuous flow method, Discrete methods, Automatic Analysis based on Multilayer Films.

UNIT- V

NMR Spectroscopy: Theory of nuclear magnetic resonance,
experimental methods of NMR spectroscopy, applications of proton
NMR including application in MRI technique

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