University of Rajasthan Jaipur

SYLLABUS

B.Sc. (Hons.)

PART-II

Examination-2024

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Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Scheme of Examination
B.Sc.(Honours) Part-II
(10+2+3 Pattern)

For a pass at each examination a candidate should be required to obtain a minimum of 36% marks in each subsidiary subjects and 40% marks in the Honours subjects, passing separately in the practicals, wherever prescribed, shall be necessary.

Successful candidates will be classified as under :

of the aggregate marks prescribed both in Honours and subsidiary subject of Part I, II, & III Examination taken together.

All the rest will be declared to have passed the examination if they obtain a minimum of 40% marks in the aggregate.

The number of papers and practicals, wherever prescribed the duration of examination, maximum marks and minimum pass marks shall be shown in the relevant syllabus.

A candidate shall be required to offer one Honours subjects and one subsidiary subject out of the following subjects to the condition that the same were offered by him as optional subjects at the First T.D.C. Examinations of the University or an examination recognized by the Universities equivalent thereto :

Honours Subjects :
1. Physics
2. Chemistry
3. Zoology
4. Botany
5. Mathematics
6. Psychology
7. Geography

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CONTENTS

Syllabus (Subsidiary Subjects) (Same Courses of Study as prescribed for Part-II T.D.C. Pass Course)

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1. PHYSICS

B.Sc. (HONS.) PART-II EXAMINATION
1. PHYSICS (HONS.)
Paper-V : Optics

Five questions are to be set taking one from each unit (each question will have an internal choice). Student will attempt all the five questions. 40% weightage will be given to problems and numericals.

Unit-I Interference

Superposition of waves from two point sources, the necessity of coherence correlation function of two light waves. Degree of partial coherences and visibility of fringes. Effective size of a point source. Brown and Twiss experiment. Self correlation function and degree of temporal coherence for quasimonochromatic light. Coherence time and wave packet. Interference of waves from two coherent point sources. Shape of Interference fringes in 3-dimensional space and their appearance on a screen. Intensity distribution in space. Fresnel's biprism experiment. Interference of waves from several synchronous sources. Directional transmission and reception of radio signals.

Interference by division of amplitude. Film of varying thickness. Colour of thin films in transmission and reflection. Fringes of equal inclination. Newton's rings. Determination of refractive index by Newton's rings. Michelson's. Interferometer. Fringes of different shapes width Michelson's interferometer. Determination of wavelength and refractive index with Michelson Interferometer fringes waves interferometer. Theory of Fabry-Perot interferometer, visibility and shape of fringes. Mountings for Fabry-Perot etalon, Lummer Gerhke Plate : basic theory and working.

Unit-II Fraunhofer Diffraction

Fraunhofer diffraction by a single slit, intensity distribution and positions of maxima and minima in diffraction pattern. Fraunhofer pattern of circular and rectangular apertures. Fraunhofer diffraction by two parallel slits., Missing orders. Diffraction by many parallel slits. Plane diffraction grating. Transmission and reflection gratings. Concave grating. Rowland's mounting. Dispersion by a grating. Rayleigh's criterion of resolution. Resolving power of a grating, RP of a telescope.

Unit-III Fresnel's diffraction and X-ray diffraction

Fresnel's diffraction by a circular aperture, straight edge and a thin slit. Cornu's spiral geometrical method to study Fresnel's diffraction Pattern. Zone plate multiplication of a zone plate.

X-Ray diffraction in crystals, atomic planes and inter-atomic plane separation in simple cubic FCC and BCC lattices. Bragg's law, Laue spots. Diffraction pattern of powdered samples.

Unit-IV Laser and Holography

Spontaneous and stimulated emission, density of states, Einstein's, A and B coefficients. Ratio of stimulated to spontaneous transitions in a system in thermal equilibrium. Energy density of radiation as a result of stimulated emission and absorption, condition for stimulated emission and absorption, condition for amplification. Population inversion, Methods of optical pumping, Energy level Scheme of He-Ne and Ruby lasers. Working of a laser source, special features of a laser source and their origin. Tunnel lasers (qualitative discussion only).

Basic concept of holography, difference between a hologram and a photograph. Construction of a hologram and reconstruction of image.

Unit-V Polarization

Plane Electromagnetic waves, E and B of plane polarized, circularly polarized and elliptically polarized light and mathematical representations. Boundary conditions for electric and magnetic fields at the vacuum dielectric interference. Reflection and refraction of EM Waves at a plane dielectric surface at normal and oblique incidence. Derivation of Fresnel's relations. Polarization by selective (dichroism) wire grid polarizer for microwaves. Polaroids Application of Polaroids in 3-D movies, Polarization by scattering.

Double refraction. Geometry of calcite crystal, Ordinary and extraordinary rays. Optical and crystallographic axes. Huygen's theory of double refraction. Propagation of plane waves in uniaxial crystals. Propagation of waves in calcite crystal with different orientation of refracting face with optic axis, quarter and half wave plates.

Optical activity, Specific rotation. Biquartz and half shade polarimeters.

Books Recommended :

1. Geometrical and Physical Optics by B.K. Mathur
2. An Introduction to Modern Optics by A.K. Ghatak
3. Optics by D.P. Khandelwal
4. An Introduction to Modern Optics by F.R. Fowles
5. Optical Physics by Lipson and Lipson.

Paper-VI : Mathematical Physics

Note : Five questions are to be set taking one from each unit (each question will have an internal choice). Student will attempt all the five questions. 40% weightage will be given to problems and numericals.

Unit-I

Orthogonal Curvilinear co-ordinate system. Scale factors, expression for gradient, divergence and curl and their applications to Cartesian, circular, cylindrical and spherical polar co-ordinate systems.

Co-ordinate transformation and Jacobian. Transformation of Covariant, Contravariant and Mixed Tensors. Addition, Multiplication and Contraction of Tensors. Metric tensor and its use in transformation of tensors. Dirac Delta Function and its properties.

Unit-II

Fourier series: Fourier theorem and computation of Fourier co-efficients. Even and odd functions, half range expansion, sums and scale changes, forced oscillations, Expansion Techniques : integration and differentiation. Introduction to Fourier transform and its simple applications.

Unit-III

Solution of differential equations—Series method : Properties of power series, solution of ordinary differential equation : Legendre's Equation, Legendre Polynomials and Functions, Hermite Polynomials.

The method of Frobenius: Solution about regular singular points, The Gamma function, the Bessel-Clifford equation.

Roots differing by an integer : Series method, Solution of Bessel equation for

(i) Roots not differing by an integer

(ii) Equal roots

(iii) Roots differing by an integer.

Basic identities involving Bessel Functions. Basic properties like orthogonality recurrence relation and generating functions of Bessel, Hermite, Legendre, and associated Legendre's function (simple applications).

Unit-IV

Solution of partial differential by separation of variable technique and its application to following Boundary Value Problems:

(i) Laplace equation in three dimensional Cartesian co-ordinate system—line charge between two earthed parallel plates.

(ii) Laplace equation in Spherical coordinate system—Electric potential about a spherical surface.

(iii) Wave equation in two dimensional Cartesian co-ordinate system Heat conduction in a thin rectangular plate.

(iv) Diffusion equation in cylindrical co-ordinate system.

Unit-V

Matrices : Inverse of a matrix, adjoint, Hermition adjoint, Solution of linear equations using matrix.

Norms and inner products, orthogonal sets and matrices, the Gram Schmidt process and the Q-R factorization theorem. Projection matrices. Least square fit of data. Eigen values and Eigen vectors, diagonalization of matrices. Examples involving up to 3×3 matrices and for the case of real symmetric and simple matrices. Solution of linear differential equations for the homogeneous and non-homogeneous cases.

Reference Books :

1. Mathematical Methods by Potter and Goldberg (Prentice Hall of India Pvt. Ltd.)

2. Applied Mathematics for Engineers and Physicists by Pipes and Harvill (McGraw Hill Book Co.)

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Syllabus : B.Sc. (Hons.) Pt.-II

Paper-VII : Quantum Mechanics

Note : Five questions are to be set taking one from each unit (each question will have an internal choice). Student will attempt all the five questions. 40% weightage will be given to problems and numericals.

Unit-I

Development of Quantum Theory : Black body radiation, Plank's Quantum Hypothesis, Specific heats of solids, The Photoelectric effect, The Compton effect, Uncertainty principle, Its applications such as (i) Non-existence of electrons in nucleus (ii) Ground state energy of H-atom (iii) Ground state energy of harmonic oscillator and (iv) Natural width of spectral lines.

The Schrödinger's equation and Stationary State : A free particle in one dimension, Generalization to three dimensions, The operator correspondence and the Schrödinger equation for a particle subject to forces, Physical Interpretation and conditions on the wave function : Normalization and Probability Interpretation, Non-normalizable wave functions and Box Normalization, Conservation of Probability, Expectation Values, Ehrenfest's Theorem, Admissibility conditions on the wave function.

Stationary States and Energy Spectra : Stationary States : Time independent Schröedinger equation, a particle in a square well potential, bound states in a square well ($E<0$), admissible solutions of wave equation (b) The Energy Eigen values-Discrete Spectrum. (c) The Energy Eigen functions; Parity (d) Penetration into classically forbidden regions.

Unit-II

The Square Well—Nonlocalized States ($E>0$). Square Potential Barrier : (a) Quantum Mechanical Tunneling, (b) Reflection at Potential Barriers and Wells. Multiple Potential Wells: Splitting of Energy-Levels; Energy Bands : (a) The Wave Function : Transfer across Potential Well. (b) A Single Square Well : Energy levels. (c) The Wave function: Transfer across N Square Wells. (d) A Regular Array of N Square Wells : Energy Levels. (e) An Infinite Array of Square Wells : The Kronig-Penney Model.

Unit-III

General Formalism of Wave Mechanics : The Schrödinger Equation and the Probability Interpretation for an N-Particle System. The Fundamental Postulates of Wave Mechanics : (a) Representation of States (b) Representation of Dynamical Variable, Expectation Values, Observables. The Adjoint of an Operator, and Self-Adjointness. The Eigen Value Problem, Degeneracy, Eigen Values and Eigen Functions of Self-Adjoint Operators. The Dirac Delta function, Observables: Completeness and Normalization of Eigen Functions, Closure, Physical Interpretation of Eigen Values. Eigen Functions and Expansion Coefficients. Momentum Eigen Functions. Wave Functions in Momentum Space : (a) Self-adjointness and Reality of Eigen Values (b) Normalization and Closure (c) The Wave Function and Operators in Momentum Space. The Uncertainty Principle, States with Minimum Value for Uncertainty Product, Commutating Observables; Removal of Degeneracy, Evolution of System with time; Constants of the motion, Non-Interacting and Interacting Systems, Systems of Identical Particles : (a) Interchange of Particles. Symmetric and Antisymmetric Wave Functions. (b) Relation between Type of Symmetry and Statistics, The Exclusion Principle.

Unit-IV

Exactly Soluble Eigen Value Problems : The Simple Harmonic Oscillator : The Schrödinger Equation and Energy Eigen Values. The Energy Eigen Functions : (a) Series Solution, Asymptotic Behaviour. (b) Orthonormality, Properties of Stationary States. The Abstract Operator Method : (a) The Ladder (or Raising and Lowering) Operators, (b) The Eigen Value Spectrum, (c) The Energy Eigen Functions, Coherent States, Angular Momentum Operators. The Eigen Value Equation for L^2, Separation of variable, Admissibility Conditions on Solutions, Eigen Values. The Eigen Functions : Spherical Harmonics. Physical Interpretation, Parity, Angular Momentum in stationary States of Systems with Spherical Symmetry : (a) the Rigid Rotator, (b) A particle in a Central Potential, The Radial Equation, (c) The Radial Wave functions.

Three Dimensional Square Well Potential : Solution in the interior Region. Solution in the Exterior Region, and Matching

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(a) Nonlocalized States (E>0) (b) Bound States (E<0). The Hydrogen Atom : Solution of the Radial Equation; Energy Levels, Stationary State Wave Functions, Discussion of Bound States.

Unit-V

Representations, Transformations and Symmetries : Quantum States; State vectors and Wave Functions, The Hilbert Space of state Vectors; Dirac Notation—(a) State Vectors and their conjugates (b) Norm and Scalar Product (c) Basis in Hilbert Space, Dynamical Variables and Linear Operators—(a) Abstract Operators; the Quantum Conditions (b) The Adjoint; Self-Adjointness (c) Eigen values and Eigen Vectors (d) Expansion of the Identity; Projection Operators (e) Unitary Operators, Representations—(a) Representation of State Vectors: The Wave function (b) Dynamical Variables as Matrix Operators (c) Products of Operators : The Quantum Condition (d) Self-Adjointness and Hermiticity (e) Diagonalization, Continuous Basis – The Schrodinger Representation, Degeneracy; Labelling by commuting observables, Change of Basis; Unitary Transformations, Unitary Transformations Induced by change of Coordinate System : Translations, Unitary Transformation induced by Rotation of Coordinate System, The Algebra of Rotation Generators; Transformation of Dynamical Variables, Symmetries and Conservation Laws, Space Inversion (a) Intrinsic Parity (b) The Unitary Operators of Space Inversion (d) Parity Non-Conservation, Time Reversal.

Reference Books :

1. P.M. Mathews and K. Venkatesan—A Textbook of Quantum Mechanics.

2. A.K. Ghatak and S. Lokanathan—Quantum Mechanics (Third Edition).

3. H.S. Mani and G.K. Mehta—Introduction to Modern Physics.

Paper-VIII : Electronics

Note : Five questions are to be set taking one question from each unit. (each question will have an internal choice). The student will attempt all 5 questions. 40% weightage will be given to problems and numericals.

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Teaching : 4hrs/week   Max. Marks 75

Unit-I

Circuit analysis : Networks: Some topological definitions. Loop and Nodal analysis of d.c. and a.c. circuits (based on Kirchoff Laws).

Two port network : Current voltage conventions, Concept of Driving point and transfer impedance open circuit, short circuit and hybrid parameters. star delta /T-π inter-conversions, open, short and characteristic impedance of symmetric T-π network.

Network theorems : (reference of DC as well as AC circuits is to be given) superposition, Thevenin, Norton, Reciprocity, Compensation. Maximum power transfer.

Unit-II

Fundamentals of Semiconductors : Intrinsic and extrinsic semi-conductors, charge densities in intrinsic. P and N type semiconductors PN Junction, Conduction by drift and diffusion of charge, PN Diode equation. Capacitance effect, Zener effect.

Rectification and Power Supply : Diode parameters and Specifications (reference of some commonly used diodes should be given), Diode Approximations. Half-wave, full-wave and bridge rectifiers, calculation of efficiency. Ripple factor and Regulation, Filters: A comparative study of shunt capacitor, L section and pi section filter, diode voltage multiplier, Zener regulator.

Unit-III

Transistors : Basic ideas, operation, CB, CE, CC configurations. Input and output characteristics (for these configurations) and current voltages, notation, Concept of DC and AC load lines, Transistor as a switch, as a current source, Transistor biasing circuits : Base bias, collector and emmitter feed back bias. Basic ideas about FET and MOSFETS.

Transistor Amplifiers : CE, CC and CB Amplifier and their approximate Analysis for gain, input and output impudence (using eber Mol's h-equivalent circuit).

Coupling of Amplifiers (basic ideas of R-C. L-C Transformer and direct coupling) basic idea of class A, B, AB and C. operation, effect of transistor Frequency capacitances on high frequency amplifier gain, gain and phase versus frequency effect of capacitors in transistor amplifier and frequency response of CE Amplifier.

Unit-IV

Amplifiers with feedback : Concept of Feed back. Stabilisation of gain by negative feed back, effects of feed back on output and input resistance and nonlinear distortion. Voltage and current feed back circuits and frequency response of feed back Amplifiers.

Oscillators : Theory of sinusoidal oscillation. Wein bridge, phase shift, Colpit, Hartley, Clapp and crystal oscillators (only an approximate calculation of oscillator frequency and gain requirements, if necessary).

Unit-V

Operational Amplifier : Differential Amplifier. Operational Amplifier, basic idea and its basic parameters, Application; Unity gain buffer, inverting, voltage amplifier, Adder, subtractor integrator differentiate, comparator, Idea of wave form generator voltage regulation.

Digital Circuits : Logic Fundamentals AND, OR, NOT, NOR, NAND and XOR gates : Symbols and their truth tables. Boolen Algebra De morgon's theorem and circuit realisation of logic functions using various digital logic families : RTL, DTL, TTL, ECL and MOS logic families.

Integrated Circuits : Basic idea about pin configuration and block diagrams of some popular IC's. Op Amp. 741. Three pin Regulators, and Timer 555 and 7400, 7 segment display.

Reference Books :

1. A.P. Malvino : Electronics Principles
2. A.P. Malvino : Digital Computer Electronics
3. Van Valcumgurg : Network Analysis
4. J. Milliman and C.C. Halkyas : Integrated Electronics
5. G.K. Mithal : Integrated Electronics.
6. J.D. Ryder : Network Analysis
7. R.P. Jain : Digital Electronics.

Physics Practicals

Max. Marks : 100   *Min. Pass Marks : 40*

Two practicals of 5 hours each spread over two days.

The students are expected to perform 15 experiments in the academic session. The suggested list of experiments is given below

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the institution may however, set other experiments of the same level and may communicate the same to the convener, Board of Studies.

1. Using platinum resistance thermometer to find the melting point of a given substance.

2. Determine the theromdynamic constant γ (gamma) = Cp/Cv using elements and Desormes method.

3. Determine thermal conductivity of a bad conductory by lee method.

4. Determination of a ballistic constant of a ballistic galvanometers and high resistance by leakage method.

5. Study of variation of total thermal radiation with température.

6. To study conductor interaction through fall to magnet in a hollow metal cylinder.

7. To study temperature variation of modulus of rigidity.

8. Plot thermo emf versus temperatures graph and find the neutral temperature uses and bath.

9. Study the magnetic field along the axis of a current carrying circular coil. Plot the necessary graph and hence find the radius of the circular coil.

10. Study of power supply using half wave. Full wave and bridge rectifier with various filter circuits.

11. Study of half wave rectifier using single diode and application of L and π section filter.

12. To study characteristics of a given transistor PNP/NPN.

13. Determination of band gap using a junction diode.

14. Study of single stage transistor audio amplifier (variation of gain with frequency).

15. To determine efm by Thomson's method.

2. CHEMISTRY

Sci ....

Max Marks: 400

	Duration (hrs)	Max. Marks	Min. Pass Marks
Paper V	3	75	
Paper-VI	3	75	120
Paper-VII	3	75	
Paper-VIII	3	75	
Practical	8	100	40

(*Complete in TWO days*)

Note: Each paper will contain ten questions having two questions from each unit. Candidates are required to attempt five questions in all selecting one question from each unit

Paper-V Inorganic Chemistry
(4 hrs / Week)

UNIT-I

Coordination Chemistry:

Werner's coordination theory, effective atomic number, chelates, nomenclature of coordination compounds, isomerism in coordination compounds.

Magnetic properties of transition metal complexes:

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution of magnetic moments, application of magnetic moment data for 3d-metal complexes.

UNIT-II

Theories of Coordination Compounds:

Valence bond theory of transition metal complexes, limitations of valence bond theory

Crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters, Jahn-Teller effect

Application of crystal field stabilization energy in explaining ionic radii of divalent ions of first transition series, heat of hydration of divalent ions of first transition series

UNIT-III

Electronic spectra of Transition metal complexes:

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagrams for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Thermodynamic and kinetic aspects of metal complexes:

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes

UNIT-IV

Chemistry of Lanthanide elements:

General study, occurrence and isolation, electronic configuration, oxidation states and ..

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lacth lanthanide contraction, magnetic properties, complex formation of lanthanide compounds.
Chemistry of Actinides:
General study chemistry of separation of Np, Pu and Am from U, electronic configuration, oxidation states magnetic properties, complexation behaviour, comparison of lanthanides and actinides, super heavy elements.

UNIT-V

Oxidation and Reduction:
Redox potential data and their analysis, redox stability in water, Frost, Latimer and Pourbaix diagrams, Application of redox data in the extraction of the elements.
Acids and bases:
Theories: Arrhenius, Bronsted-Lowry, Lux-Flood. Solvent system concept and Lewis concept of acids and bases Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness, symbiosis, theoretical basis of hardness and softness, electronegativity, hardness and softness.
Non-aqueous Solvents:
Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Paper-VI Organic Chemistry
(4 hrs./week)

Unit-I

Alcohols
Classification and nomenclature.
Monohydric alcohols: Primary, secondary and tertiary alcohols, methods of preparation. Hydrogen bonding. Acidic nature, reactions of alcohols.
Dihydric alcohols: Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)₄ and HIO₄] and pinacol-pinacolone rearrangement.
Trihydric alcohols: Nomenclature, methods of formation and chemical reactions of glycerol
Phenols
Nomenclature, structure and bonding. Preparations of phenols, physical properties and acidic character. Comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols. Mechanism of Fries, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Laderer-Manasse reaction and Reimer-Tiemann reaction
Ethers and Epoxides
Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions-cleavage and autooxidation. Ziesel's method, Crown ethers.
Synthesis of epoxides. Acid and base catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides

UNIT II

Aldehydes and Ketones
Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to formaldehyde, acetaldehyde, acetone, benzaldehyde, acetophenone and

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... ... ionic. Physical properties, reactivity. Mechanism of nucleophilic addition to carbonyl group, condensation with ammonia and its derivatives. Benzoin, Aldol and Knoevenagel condensation. Perkin, Wittig, Mannich and Cannizzaro's reactions.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones. MPV (Meervein Poondrof Verley) reduction, Clemmensen, Wolff-Kishnner, LiAlH$_4$ and NaBH$_4$ reductions. Halogenation of enolizable ketones.

An introduction to α,β-unsaturated aldehydes and ketones. Preparation and properties of acrolein, crotonaldehyde and vinyl methyl ketone, Michael reaction.

Acidity of α-hydrogen, alkylation of diethyl malonate and ethyl acetoacetate (EAA). Synthesis of EAA. The Claisen condensation, keto-enol tautomerism in EAA, synthetic importance of diethyl malonate and ethyl acetoacetate. Alkylation and acylation of enamines.

UNIT-III

Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substitution on acid strength, comparison of acidity with phenols. Preparation of carboxylic acids. Reactions of carboxylic acid, Hell-Volhard-Zelinsky reaction, synthesis of acid chlorides, ester and amides. Reduction mechanism of decarboxylation.

Aromatic carboxylic acids: Synthesis and reactions of benzoic acid, salicylic acid, phthalic acid and cinnamic acid

Methods of preparation and chemical reaction of α, β and γ-hydroxy acids, malic, tartaric and citric acids.

Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: Methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution

Preparation of carboxylic acid derivatives, chemical reactions. Mechanism of esterification and hydrolysis (acidic and basic)

Fats, Oils and Detergents : Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils, saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

UNIT-IV

Organic Compounds of Nitrogen

Preparation and chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid

Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amine. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel phthalimide reaction, Hofmann Bromamide reaction. Reaction of amines. Aryl diazonium salts: Preparation and synthetic transformations, azo coupling. Diazomethane and its applications

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NM Spectroscopy

Proton magnetic resonance spectroscopy : Introduction, nuclear spin and energy levels, transitions, equivalent and non-equivalent protons, nuclear shielding and deshielding, chemical shift, spin-spin coupling and coupling constant, areas of signals, interpretation of PMR spectra of simple organic molecules like C_2H_5Br, C_2H_5OH, CH_3CHO, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone

Note: Mechanism of the reactions should be studied wherever possible.

Paper-VII Physical Chemistry
(4 hrs./week)

Unit - I

Electrochemistry:

(a) Electrolytic conduction, specific, equivalent and molar conductivities and their determination. Variation of conductance with dilution. Effect of temperature, pressure, solvent and viscosity on conductance.

Kohlrausch's law and its applications in determination of

(1) Degree of dissociation and dissociation constant of weak acids

(2) Solubility of sparingly soluble salts

(3) Hydrolysis constant

(4) Ionic product of water

Inter-ionic attraction theory, quantitative treatment of theory of strong electrolytes, verification of the Debye-Huckel Onsager equation, activity and activity coefficient, ionic strength.

(b) Transference number and their determination by

(1) Hittrof's method

(2) Moving boundary method.

Abnormal transference numbers.

Unit – II

Thermodynamics:

Limitations of first law of thermodynamics. Spontaneous processes. Second law of thermodynamics. Carnot cycle, Kelvin Scale of temperature, concept of entropy. Entropy change for an ideal gas, entropy changes for physical transformation. Entropy of mixing, physical significance of entropy. Free energy and work function. Criteria of chemical equilibrium. Gibb's Helmholtz equation. Third law of thermodynamics and determination of absolute entropies. Effect of temperature on free energy and enthalpy. Maxwell's thermodynamic relations.

Unit – III

Spectroscopy

Electromagnetic radiations and wave parameters interaction of electromagnetic radiations with matter. Ultra violet and visible spectroscopy having absorption interaction. Chromophores and auxochromes, determination of wavelength (max) and molar extinction coefficient of compound Both chromic and hypsochromic shifts. Colours in complexes. Application of U.V

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visible spectroscopy, electronic spectra Modes of vibrations in diatomic, linear and non-linear poly-atomic molecules. Force constant and its significance. Applications of infrared spectroscopy in elucidation of structure of molecules

Unit – IV

Quantum Chemistry:

Quantum theory of radiations, photoelectric effect and Crompton effect. Limitations of Bohr's model. Heisenberg uncertainty principle, wave nature of electron, de Broglie wave equation and its experimental verification. Operators and their applications. Sinusoidal wave motion, derivation of Schrodinger's wave equation. Physical significance of ψ (psi) and ψ^2 (psi)^2. Eigen values and Eigen functions. Characteristics of wave functions. Normalization and orthogonality of wave functions. Solution of Schrodinger wave equation. Particle in one dimension box.

Unit – V

Photochemistry:

Absorption of light, Grothus – Dropper law. Einstein law of photochemical equivalence. Quantum yield of photochemical reactions, reasons for high and low quantum yield of photochemical equations Primary and secondary processes, photochemical reactions such as (1) $H_2 + Cl_2$ reaction (2) photolysis of ammonia (3) hydrolysis of monochloro acetic acid.

Consequences of light absorption phosphorescence, fluorescence, chemiluminescence and photosensitization.

Nuclear Chemistry:

Nature of radioactivity, artificial radioactivity, radioactive disintegration. Group displacement law half - life period and average life period. Radioactive equilibrium, artificial radioactivity and transmutation of elements. Fundamental particles, positron, antiproton, anti-neutron and anti neutrinos

Nuclear Models. Liquid drop model, magic number and shell model.

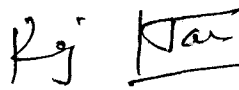Nuclear Fission nuclear reactor and atom bomb

Nuclear Fusion Hydrogen bomb

Applications of radioactivity in chemistry

Tracer techniques:

(1) Radiocarbon dating

(2) Reaction mechanism

(3) Biology and medicine

Suggested Books:

1 Physical Chemistry by S Glasston

2 Elements of Physical Chemistry by Lewis and Glasston

3 Physical Chemistry by Atkins.

4 Thermodynamics by Mishra & Rastogi

5 Physical Chemistry by Moore

Paper-VIII Analytical Chemistry
(4 hrs./week)

UNIT-I

Chromatography: Principles of absorption and partition chromatography, techniques and application of column, paper and thin layer chromatography. Electrophoresis and its applications in separation of amino acids.

Ion exchange methods : General discussion, action of ion exchange resins, column operation, experimental techniques, types of ion exchange resins, determination of the following pairs by ion exchange techniques : (a) chloride and bromide (b) nickel and cobalt.

UNIT-II

Conductometric titrations: The basis of conductometric titrations. Apparatus and measurement, application of conductometric titrations. High frequency titrations, advantages of the techniques, some examples of high frequency titrations.

Potentiometric titrations: Introduction, electrodes, instrumentation, potentiometric titrations, differential potentiometric titrations, automatic potentiometric titrations, location of end points, determination of some metals through potentiometric titrations.

UNIT-III

Spectrophotometric titrations: Basic principle, instrumentation experimental techniques, spectrophotometric analysis of Fe (III), Co (I), Ni (II), Fe (II) in presence of Al (III) with EDTA.

Nephelometry & Turbidimetry: General discussion, instrumentation, some nephelometry determination (a) sulphate (b) phosphate.

Unit-IV

Flame emission and Atomic absorption spectrometry: Basic principle, instrumentation. Nebulization, flames and flame temperatures, interferences, flame spectrometric techniques.

Atomic emission spectrography: Spectroscopic sources, instruments for emission spectrographic analysis, qualitative and quantitative spectrographic analysis. Qualitative spectrographic analysis of a non ferrous alloy and complex organic mixture.

UNIT-V

Thermal analysis: Thermogravimetry (TG) instrumentation, application. Differential thermal analysis and differential scanning colorimetry, instrumentation.

(8 hrs. or 12 periods / week) (Spread over Four days)

Inorganic Chemistry

Quantitative (Gravimetric) (*any three*)

  a) Estimation of Barium (as sulphate)
  b) Lead (as chromate)
  c) Copper (as Cuprous thiocyanate)
  d) Nickel (as dimethyl glyoximate)
  e) Silver (as chloride)
  f) Zinc (as Zinc ammonium phosphate)
  g) Magnesium (as Magnesium hydrogen phosphate, $MgHPO_4$)

Inorganic Preparations (*any four*) of coordination compounds and their characterization:

  a) Chloropentamminecobalt(III) chloride.
  b) Cuperous chloride, Cu_2Cl_2.
  c) Tetramminecopper(II) sulphate.
  d) Pyridine complex of copper
  e) Prussian blue.
  f) Hexaamminenickel(II) chloride

Organic Chemistry

(i) Identification of simple organic compound and preparation of its suitable derivative.

(ii) Simple one step organic preparation-the students are expected to perform at least five of the following preparations:

  (a) Preparation of m-dinitrobenzene from nitrobenzene.
  (b) Preparation of acetanilide from aniline.
  (c) Preparation of aspirin from salicylic acid.
  (d) Preparation of o-and p-bromo acetanilide from acetanilide.
  (e) Preparation of o-and p-bromo aniline from o-and p-bromoacetanilide.
  (f) Partial reduction, m-dinitrobenzene into m-nitro aniline.
  (g) Preparation of methyl orange from sulphanilic acid.
  (h) Preparation of acetylglycine from glycine.

Physical Chemistry

Exercises

At least four experiments are to be performed from each Unit.

Chemical Dynamics experiments:

  a) To find the velocity constant of the hydrolysis of methyl acetate catalyzed by an acid
  b) To determine the order of saponification of ethyl acetate by NaOH.
  c) To find out the rate constant and order of reaction between potassium persulphate and potassium iodide.
  d) To study the reaction between acetone and iodine

Transition temperature:

  a) Determination of transition temperature by thermometric method

Molecular weight determination:

  a) Determination of molecular weight of non-volatile solute by cryoscopic method and application of technique for determination of the Van't Hoff factor or degree of dissociation of an electrolyte

Conductometry...

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a. to find out the strength of strong acid by titrating it against strong alkali.
b. find out the strength of weak acid by titrating it against a strong alkali
c. to find out the strength of hydrochloric acid and acetic acid in a mixture of both, by titrating it against sodium hydroxide.
d) Determination of equivalent conductivity of an electrolyte at different dilutions

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(Instructions to the Examiner)
B.Sc. (HONS.) Pt.-II CHEMISTRY PRACTICAL EXAMINATION

Max. Marks: 100   **Duration of Exam: 8 hrs.**   **(Complete in Two days)**

Inorganic Chemistry

Ex.1	Quantitative: One of the gravimetric exercises mentioned in the syllabus.	18
Ex.2	Inorganic preparation: One of the exercises mentioned in the syllabus.	12

Organic Chemistry

Ex. 3	Identification of the simple organic compound and preparation of their suitable derivative.	15
Ex. 4	Organic preparation: One of the exercises mentioned in the syllabus.	10

Physical Chemistry

Ex. 5	Perform one of the physical chemistry experiments given in the syllabus.	25
Ex. 6	Viva-voce	10
Ex. 7	Record	10
		100

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Syllabus: B.Sc. Zoology (Hons.) Part-II
(2022-2023)

Scheme:

Paper VII	: Animal Diversity-3	Max. Marks-50
Paper VIII	: Animal Diversity-4	Max. Marks-50
Paper IX	: Physiology-1	Max. Marks-50
Paper X	: Physiology-2	Max. Marks-50
Paper XI	: Immunology	Max. Marks-50
Paper XII	: Ethology	Max. Marks-50
Practicals	: 2 Days (8Hrs.)	Max. Marks-100

Scheme of Examination: **Max. Marks: 50**

1. There will be 5 Questions in each paper. All questions will be compulsory and carry equal marks.
2. Question number 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Questions should be evenly distributed covering entire syllabus.
3. Each paper is divided into four units/sections. There will be one question from each unit/section. The question number 2 to 5 will have internal choice.

Seminars, posters, models, educational tour report, practical record etc., will carry internal marking which will be added in the practicals.

Paper-VII: Animal Diversity –3

Section-A

1. Origin and general characteristics of chordates.
2. Protochordates – Classification up to orders, Interrelations, Structural organization of Hemichordates, Urochordates and Cephalochordates and their affinities.
3. Agnatha – Classification upto orders.

Section-B

4. Fishes- Origin and evolution of fishes; Classification upto order, Types of scales and fins parental care, respiratory organs, lateral line system and migration.
5. Pisciculture.

Section –C

6. Amphibians – Classification upto orders Origin and evolution of Amphibia and parental care, Neoteny.

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Section –D

7. Reptiles – Classification upto orders, extinct reptiles, skull types in reptilians, biting apparatus and biting mechanism of any poisonous snake, poisonous & nonpoisonous snakes of India.

Paper-VIII: Animal Diversity-4

Section – A

1. Origin of birds,Bird migration and principles of bird flight, types of feathers, flight adaptations, perching mechanism.
2. Palaeognathae and Neognathae – Distribution and classification upto orders, beaks and claws.
3. Poultry keeping.

Section-B

4. Mammals – Origin, classification upto orders and general characters, dentition, volent adaptations and aquatic adaptations in mammals.

Section –C

5. Comparative anatomy of systems; Scoliodon, Frog, Varanus, Pigeon and Rabbit (Integument, skeletal system and digestive system).

Section- D

6. Comparative anatomy of systems: Scoliodon, Frog, Varanus, Pigeon and Rabbit (Circulatory system including heart and aortic arches, Respiratory system, sensory organs (Eye & Ear) & urinogenital system).

Paper-IX: Physiology –1

Section-A

1. Chemical foundations of physiology- solutions, osmotic pressure, diffusion, pK and pH buffers.
2. Osmoregulation: Osmosis, diffusion, osmoregulation in animals, osmotic conformers, osmoregulation in hypotonic &hypertonic water animals and osmoregulation in terrestrial animals.
3. Physiology of excretion: Kinds of nitrogenous excretory end–products (ammonotelic, uricotelic and ureotelic), role of liver in the formation of these end products, functional architecture of mammalian kidney tubule and formation of urine: hormonal regulation of water and electrolyte balance.

Section -B

4. Blood: Composition and function of blood and lymph, blood groups, blood coagulation, structure and function of hemoglobin.

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5. Heart: Structure, origin, conduction and regulation of heart beat, cardiac cycle and ECG.
6. Peripheral circulation: Blood pressure, capillary pressure and regulation.

Section-C

7. Respiration: Mechanism and control of breathing, concept of partial pressure of gases, Bohr's & Haldane's effect and chloride shift.
8. Structure and function of eye and ear in humans.

Section-D

9. Nutritional requirements and disorder due to proteinand energy malnutrition, vitamin & mineral deficiencies.
10. Digestion and absorption of dietary components, hormonal and neuronal control of digestion.

Paper-X: Physiology -2

Section-A

1. Functional architecture of a neuron,physiology of nerve impulse: Origin and propagation of nerve impulse, synaptic transmission, spinal reflex arc and central control of reflex action.
2. Functional architecture of skeletal muscle, chemical and biophysical events during contraction and relaxation of muscle fibers.

Section-B

3. Type of endocrine glands: Their secretions and functions, classification of hormones, histology of endocrine glands: Pituitary gland, pineal gland, adrenal, thyroid, parathyroid, islets of Langerhans, testis and ovary.

Section-C

4. Hormonal control of male and female reproduction and implantation, parturition and lactation in mammals.
5. Preliminary idea of neurosecretion: Hypothalamic control of pituitary function, neuroendocrine and endocrine mechanism of insects.

Section - D

6. Thermoregulation: Physiological process, thermoregulation in cold and hot environments, thermoregulation in poikilotherms and homeotherms.
7. Physiology of high altitude: Acclimatization & adaptations and diseases due to high altitudes.
8. Physiology of diving (basic outline): Oxygen toxicity, decompression and decompression models.

2 by

Paper –XI: Immunology

Section - A

1. Immunology: Definition, types of immunity –innate & acquired, humoral and cell – mediated.
2. Organs of immune system: Thymus, bone marrow, lymph node, spleen, tonsils, and Peyer's patch.
3. Antigen: Antigenicity of molecules and haptens.

Section - B

4. Antibody : Structure, properties and function of IgG, IgM, IgD, IgA and IgE.
5. Antigen-antibody reactions: Precipitation reaction, agglutination reaction, neutralizing reaction, complement & lytic reactions and phagocytosis.

Section - C

6. Cells of immunity: Macrophages, lymphocytes (B- and T types), T-helper cells, T-killer cells, plasma cells and memory cells.
7. Mechanism of humoral or antibody mediated immunity and cell mediated immunity.

Section - D

8. MHC: Structure and function of class I, II and III MHC molecules, genomic map of MHC genes, Regulation of MHC expression.
9. Immunotolerance.
10. Autoimmunity: Involvement of CD_4^+ cells, contributing factors in autoimmune disease, Autoimmune disease: Hasimoto's thyroiditis, Type I diabetes, Myasthenia Gravis, Rheumatoid arthritis, autoimmune hemolytic disease.
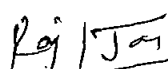
Paper –XII: Ethology

Section - A

1. Introduction: Ethology as a branch of biology and its significance.
2. Concepts of ethology: Fixed action pattern, action specific energy, sign stimulus, innate releasing mechanism, learning and imprinting.
3. Orientation: Taxes and Kineses, Navigation, Homing and territoriality.
4. Methods of studying brain and behaviour: Neuroanatomical, neurochemical and neurophysiological techniques.

Section - B

5. Feeding strategies among animals
6. Genetic and environmental components in the development of behavior.
7. Social behavior of honey bees, termites and wasps, social hierarchy in monkeys.
8. Hormones and behavior; Role of pherormones in behavior.

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Section - C

9. Reproductive behavior: Evolution of sex and reproductive strategies, mating systems, courtship, sexual selection and parental care, selfishness, kinship and altruism.
10. Biological rhythms: Circadian rhythms and migration of fishes & birds.

Section - D

11. Types of Learning and memory: Conditioning, habituation, insight learning, association learning, reasoning, cognitive skills, trial & error.
12. **Wildlife of Rajasthan.**

University of Rajasthan
Syllabus: B.Sc. Zoology (Hons.) Part-II

Min. Marks 40   **8 hrs. /week**   **Max. Marks 100**

Practicals

1. **Anatomy: Study of the following with dissection**
   - Any edible fish (Wallago /Labeo): Afferent & efferent branchial arteries, cranial nerves, eye muscles, Weberian ossicles and internal ear.
   - Accessory respiratory organs- Heteropneustis, Anabas, Ophiocephalus and Clarius.

2. **Museum specimens:**
   Herdmania, Ascidia, Botryllus, Pyrosoma, Ammocoete larva, *Petromyzon,Myxine, Scoliodon, Sphryna, Torpedo, Chimaera, Acipenser, Amia, Lepidosteus, Labeo, Clarius, Anguilla, Hippocampus, Syngnathus, Exocoetus, Echeneis,* Any flat fish, *Protopterus, Lepidosiren, Ichthyopis, Proteus, Necturus, Siren, Ambystoma,* Axolotl larva, *Salamander, Alytes, Rhacophorus, Chelone, Testudo, Hemidactylus, Varanus, Phrynsoma,* Draco, *Chameleon, Sphenodon, Mabuya, Eryx, Hydrophis, Viper, Naja, Krait, Crocodilus, Alligator, Gavialis, Archaeopteryx,* Peacock, Ostrich, Emu, *Ornithorhynchus, Tachyglossus, Didelphis, Shrew, Kangaroo,* Bat, *Manis, Loris, Presbytis and Macaca.*

3. **Osteology of Frog, Varanus, Fowl and Rabbit (use of models /charts/ artificial skeleton & bones etc.):** Skull, vertebral column, girdles and limbs.

4. **Study of permanent microscopic slides:**
   Dololium, Salpa, Oikopleura, Amphioxus: whole mount and T.S. passing through different regions of the body, Ammocoete larva: T.S. passing through different regions of the body, *Scoliodon*: T.S passing through different regions of the body, Mammalian

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histology: T.S. of Liver, lung, testes, ovary, pancreas, thyroid, parathyroid, adrenal, stomach, duodenum, intestine, bone &cartilage, L.S. / T.S.of pituitary.

5. **Permanent preparation**
Herdmania: Pharyngeal wall and spicules, *Amphioxus*: oral hood, velum and pharyngeal wall and Edible fish : scales.

6. **Microtomy**: Fixation, processing, section cutting & staining (H&E) of organs and morphometric measurements.

7. **Physiology**
   (i) Blood: Haemoglobin estimation, Hematocrit, WBC and RBC counting, clotting time period and blood pressure.
   (ii) Blood film: Identification of various types of leucocytes.
   (iii) Study of salivary amylase and catalase (liver) activities.
   (iv) Investigate passive diffusion through cell membrane of mammalian red cells (0.9% NaCl, 0.4% NaCl, 1% NaCl, 2% urea, 3 % glycerol and distilled water).

8. **Immunology**
   (i) Blood groups: ABO and Rh factor.
   (ii) Widals test.
   (iii) Slides: Thymus, lymph nodes and spleen.

9. **Ethology**
   (i) Food preference in *Tribolium*.
   (ii) Antennal grooming in cockroach.
   (iii) Chemical communication among earthworms and ants.
   (iv) Reaction of *Paramecium* towards dilute acid drop.

10. **Educational tour to museum of natural history/sea shore /wild life sanctuary/Zoo for collection and on the spot observation of living animals/ local visit to study biodiversity. Students are required to submit the report of the visit.**

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B.Sc. Zoology (Hons.) Part-II

Scheme of practical examination and distribution of marks

8Hrs. (2 days, 4hrs /day)

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Min marks: 20   **Max marks: 50**

    Ist day   **Regular**

1.	Anatomy	09(6+3)
	• Major	
	• Minor	
2.	Permanent preparation/ microtomy	05
3.	Exercise in Immunology	05

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4.	Identification and Comments on spots (1 to 8)	16
5.	Viva voce	5
6.	Class Record	5
7.	Seminar /Project Report/Collection	5

Min marks: 20   **Max marks: 50**

IIndday

1.	Exercise in Physiology (a) Major (b) Minor	14(8+6)
2.	Exercise in Ethology	05
3.	Identification and Comments on spots (1 to 8)	16
4.	Viva voce	5
5.	Class record	5
6.	Seminar/Project Report/Collection	5

Notes:

- **With reference to anatomy, the candidate must be well versed with the techniques of flag labeling and black paper insertion as the case may be for a clear illustration. Study of the various systems may be carried with the help of charts/ models/ CD-ROM's / high resolution picture/ video's of lives anatomy and web-site dedicated to alternative of animal anatomy providing free wares.**
- **With reference to whole mounts and museum specimens in case of unavailability, the animal types should be substituted with diagrams/ photographs/ models etc.**
- **Students will keep records of all work done in the practical records.**
- **It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.**
- **The details methodology may be asked to be written where ever is necessary.**

Recommended books:

1. Alcock J: Animal Behavior: An Evolutionary Approach. Sinauer Associates 2013.
2. Animal Societies and Evolution. Scientific American Publications.
3. Barrington EJW: The Biology Hemichordata and Protochordata. Oliver & Boyd, London 1965.
4. Berril NJ: The Tunicates. The Roy Society, London.
5. Breed MD and Moore J: Animal Behavior. Academic Press. 2015.
6. Colbert EH, Morales M, Minkoff EC, Colberts: Evolution of the Vertebrates: A History of the Backboned Animals through Time. 5th edition Wiley Liss 2001.
7. Colbert EH: Evolution of the Vertebrates. 2nd edition John Wiley & Sons, New York 1969
8. Costanzo LS: Physiology. 4th edition Saunders Inc.2009.
9. David R, Burggren Wand French K: Eckert Animal Physiology. 5th edition W H Freeman & Company, New York 2001
10. Fox SI: Human Physiology. 8th edition McGraw Hill Education 2003.

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11. Goldsby RA, Kindt TJ and Osborne BA: Kuby Immunology. WH Freeman and Co., New York 2002.
12. Grizimek's Encyclopedia of Ethology.
13. Hall JE: Guyton and Hall Textbook of Medical Physiology. 12th edition Saunders Publications 2010.
14. Hand book of Ethological Method. Laharen Publications Garland STPM Press.
15. Hill RW, Wyse GA, Anderson M: Animal Physiology. 3rd edition Sinauer Associates Inc.USA 2012.
16. Kotpal RL: Modern Text Book of Zoology: Vertebrates. Global Media Publications 2010.
17. MacFarland D: Animal Behavior: Psychobiology, Ethology and Evolution 3rd edition Longman 1998.
18. Manning A, Dawkins MS: An Introduction to Animal Behavior. Cambridge University Press 2012.
19. Mathur R: Animal Behavior. Rastogi Publications 2017.
20. Murphy K: Janeway's Immunology. Garland Science; 8th edition 2011.
21. Owen J, Punt J, Stranford S: Kuby Immunology. 7th edition WH Freeman & Co. Ltd. 2013.
22. Prasad SN and Kashyap V: A Textbook of Vertebrate Zoology.13th edition Wiley Eastern Ltd. 2011.
23. Sastry KV: Animal Physiology and Biochemistry. 2nd edition Rastogi Publications 2014-15.
24. Vander AJ, Sheerman J, Liciano D: Human Physiology: The Mechanies of Body Function. McGraw Hill Co., New York 1998.
25. Verma PS, Tyagi BS, Agarwal VK: Animal Physiology. 6th edition S. Chand& Co., 2004.
26. Wake MH: Hyman's Comparative Vertebrate Anatomy. 3rd edition University of Chicago Press Ltd. London 1992.
27. Werlace RA: Animal Behavior. Good Year Publishing Co., Inc.
28. Young JZ: The Life of Mammals. Oxford University Press 1970.
29. Young JZ: The life of Vertebrates. 2nd edition Oxford University Press. London 1962.

4. BOTANY

B.Sc. Part I (Hons)

Maximum Marks: 400   **Min. Pass Marks: 160**

Paper-I Cytology, Genetics and Plant Breeding	75marks
Paper-II Algae, Fungi and Bryophyta	75marks
Paper-III Plant Physiology and Biochemistry	75marks
Paper-IV Ecology and environmental science	75marks
Practical (6 hrs.)	100marks

B.Sc. Part II (Hons)

Maximum Marks: 400   **Min. Pass Marks: 160**

Paper-I Molecular biology	75marks
Paper-II Pteridophyta, Gymnosperm and Paleobotany	75marks
Paper-III Morphology and Anatomy of angiosperms	75marks
Paper-IV Microbiology and plant pathology	75marks
Practical (6 hrs.)	100marks

B.Sc. Part III (Hons)

Maximum Marks: 400   **Min. Pass Marks: 160**

Paper-I Plant Biotechnology	75marks
Paper-II Systematics of angiosperms	75marks
Paper-III Plant utilization rind Ethanobotany	75marks
Paper-IV Embryology of angiosperms and Seed science	75marks
Practical (6 hrs.)	100marks

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UNIT-I

Structure of Nucleic Acid

Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation. cot curves, Organelle DNA - mitochondria and chloroplast DNA. Structure of RNA types of RNA (tRNA, mRNA, Ribosomes, miRNA, siRNA) and their functions.

DNA replication, damage and repair

Replicons-linear, circular and D-loops, initiation of replication, DNA polymerases, helicase, primase and other enzymes and proteins used in replication, coordinating synthesis of the leading and lagging strands, Okazaki fragments, Causes of DNA damage and molecular mechanisms of repair - excision repair system in bacteria and eukaryotes, base excision, mismatch repair systems.

UNIT-II

Transcription

Prokaryotic and eukaryotic RNA polymerases, promoter sequences, start point for RNA polymerase, transcription initiation, promoter clearance and elongation, termination, attenuation and antitermination.

RNA Modification

Split genes concept of introns and exons, removal of introns, spliceosomemachinery\ splicing pathways, alternative splicing.

UNIT-III

Translation, Protein synthesis in Prokaryotes and Eukaryotes: Assembly line of polypeptide chain, ribosome structure and assembly, various steps in protein synthesis,structure of t-RNA, aminoacyl tRNA synthetase,Proteins involved in initiation,

elongation and termination of polypeptides; fidelity of translation.Inhibition of protein synthesis, Regulation of translation.
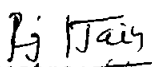
Gene regulation

Prokaryotic transcription regulation: Lac and Trp operons, cis and trans acting elements. eukaryotic transcription regulation, protein-protein interactions, DNA binding domains, histone acetylation, promoter activation and turning on off the gene

Suggested laboratory exercises

1. Preparation of culture medium (LB) for E. coli (both solid and liquid) and raise culture ofE. coli
2. Demonstration of antibiotic resistance. (Culture of E. coli containing plasmid (pUC 18/19) in LB medium with/without antibiotic pressure and interpretation of results).
3. Isolation and quantitative estimation of DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A260 measurement).
4. To perform Ames test in Salmonella / E. coli to study mutagenicity.
5. To isolate plant DNA.
6. Study of semiconservative replication of DNA through micrographs/schematic representations.

SUGGESTED BOOKS

1. Karp. G. 2010 Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M. Kleinsmith,, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell 7th edition, Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson J.D., Baker D.A., Bell S. P., Gann A., Levine M., andLosick R., 2008. Molecular Biology of the Gene. 6th editions. Cold Spring Harbour Lab. Press, Pearson Pub.

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VI Paper:Pteridophyta, Gymnosperm and Paleobotany

UNIT-I

Pteridophytes: History, occurrence and distribution, general characters,classification and economic importance, Silent features of primary vascular plants.

Comparative study of morphology, anatomy and reproduction of *Pistolum, Lycopodium, Selaginella,Equisetum, Marsilea, Pteris.*

Heterospory and seed habit, Detailed account of stellar system.

UNIT-II

Gymnosperms: Classification and salient features; Evolutionary significance of gymnosperms.

Comparative study of morphology, anatomy and reproduction of Cycadales-*Cycas;* Coniferales-*Pinus;* and Gnetales- *Ephedra.*

UNIT-III

Paleobotany: Fossil formation and types of fossils.

Geological time scale: sequence of plants in geological time.

Fossil Pteridophytes: Rhynia, Lepidodendron, Calamites.

Fossil gymnosperms: Williamsonia.

Applied aspects of Palaeobotany: Exploration of fossil fuels.

Suggested laboratory exercise

Pteridophytes

Study of Specimens, external morphology and T.S. of Stem of the following

- *Lycopodium:* T.S. of stem
- *Selaginella:* T.S. of stem
- *Equisetum:* T.S. of stem
- *Marsilea*: Sporocarp, Petiol
- *Pteris*

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Gymnosperms

External Morphology and Permanent slides of-

- *Cycas* - Coralloid roots, Rachis (T.S.), Leaflet (V.S.) *Cycas*- Megasporophyll and Male cone with Microsporophyll, Mature Ovule.
- *Pinus*- Stem (TLS & RLS), Needle (V.S.), Male and Female Cone, Mature Ovule
- *Ephedra*- Stem (T S.), Male and Female Flowers, Mature ovule
- *Williamsonia*- Chart Specimen (fossil).

Suggested Books

1. Gifford I M. and Foster, A.S.1989. Morphology and evolution of vascularPlants.W H Freemam& Co. New York, USA.
2. Sporne. K R. 1991 >The morphology of gymnosperms. B.I. Publication Pvt. Ltd. Mumbai, Kolkata, Delhi.
3. Wilson N.S. and Rohwell, G.w. 1993 Paleobotany and the evolution of plants (2nd edition) Cambridge University Press. UK.
4. Sharma O.P. Pteridophytes. 2000, Today and Tomorrow Publication.
5. Sarabhar, R.C. and Saxena R.C. 1990. A text book of Botany. Rastogi Public&Meerut

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VII Paper: Morphology and Anatomy of Angiosperms

UNIT-I

Basic body plan of a typical dicot and Monocot plant; Plant diversity based on Habitat, Habit (Longevity), Body forms and on the nature of Stem.

Monopodial and sympodial branching; Branching pattern and canopy architecture in trees; Modular type of growth.

Types of inflorescences and fruits.

UNIT- II

Structure and function of Plant tissues: Meristematic, Permanent (Simple and complex) and Secretory tissues.

Plant tissue system: Epidermal tissue system, Ground tissue system and vascular tissue system.

Shoot Apical Meristem and Root Apical Meristem: Organizational theories.

Primary growth in plants: Morphology and Internal structure of Root, Stem and Leaf of Monocot and Dicot Plants.

UNIT- III

Secondary Growth in plants: Vascular cambium: structure and function; Secondary Growth in stem and roots, Formation of wood (secondary xylem); Annual Rings. Cork cambium: structure and function; formation of Periderm and its significance.

Modifications in stem and roots.

Anomalous secondary growth in plants

Leaf: Types, Phyllotaxy and modifications.

Suggested Laboratory Exercises:

- Study of commonly occurring dicotyledonous plant to understand the body plan and modular type of growth.
- Life forms exhibited by flowering plants (by visit to a forest or a garden).
- L.S. of shoot tip to study the organization of meristem and origin of leaf primordial.

- Monopodial and sympodial types of branching in monocots & dicots.
- Anatomy of primary and secondary growth in monocots and dicots using hand cut sections of sunflower, maize, Cucurbita stem and root.
- Monocot- maize (root, stem and leaf).
- Dicot-*Helianthus, Cicer*, and *Mangifera* (root, stem and leaf).
- Anomalous secondary growth in stem: *Salvadora, Bignonia, Bougainvillea Boerhavia, Nyctanthes, Leptadenia, Dracaena*.
- Study of diversity in leaf shape and size. Internal structure of leaf-Dorsiventral and isobilateral leaves; study of stomatal types.

Suggested Books:

1. Cutter E.G. 1971. Plant Anatomy: Experiment and Interpretation. Part II Organs. Edward Arnold, London.
2. Esau K. 1977. Anatomy of seed plants, 2nd edition, John Wiley and Sons New York.
3. Fahn, A. 1974. Plant anatomy 2nd edition. Pergamon press. Oxford.
4. Crang, R. *et al*, 2018. Plant anatomy: a concept based approach to the structure of seed plants.

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VIII Paper: Microbiology and Plant Pathology

UNIT-I

Discovery of Microorganisms: History of Microbiology; Classification of Micro-organisms and characteristic features of Virus, Bacteria, Fungi, Phytoplasma and Algae.

Methods in Microbiology: basic principles of Microscopy, micrometry, staining, sterilization methods, culture media, pure culture methods, Growth curve

Ultrastructure of Micro-organisms: Fine structure of prokaryotic and eukaryotic microorganisms. Viruses- symmetry and classification, ultrastructure of tobacco mosaic virus (TMV), bacteriophage T4; ultrastructure of phytoplasma

Genetic recombination in prokaryotes: conjugation, transformation, and transduction.

UNIT-II

General account of plant pathogens: Symptoms of diseases in plants by different pathogens, effect of environment on disease development.

Plant diseases by fungi: Black rust of wheat, loose smut of wheat, green ear disease of Bajra, white rust of crucifers, red rot of sugarcane, late and early blight of potato.

Other Plant diseases: symptoms, diseases cycle and management of Citrus canker, Tobacco mosaic disease, little leaf of brinjal, black heart of potato, root knot of nematode.

Pathogen attack and defense mechanism: enzymes involved in disease development, structural and biochemical defense in host plants.

UNIT-III

Plant disease management: physical, chemical and biological disease management. Integrated Pest Management.

Economic importance of micro-organisms: economic importance of virus, bacteria, fungi. Social-economic importance of plant diseases

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Role of micro-organisms: in biogeochemical cycling of nitrogen and carbon, biological nitrogen fixation- nodule formation, mechanism, importance in agriculture.

Industrial application of micro-organisms: alcohol, citric acid, milk products, antibiotics.

Suggested laboratory exercises

Microbiology

- Microscope and various parts description.
- Sterilization techniques for microorganisms.
- Study of yeast lactobacilli and cyanobacteria.
- Media preparation (Nutrient agar).
- Culture of microorganisms by streaking on agar plates.
- Study of diseases- Citrus canker, Tobacco mosaic disease, little leaf of brinjal, black heart of potato, root knot of nematode.
- Bacteriophage (photograph).
- Study of symptoms of virus infected plants.
- Bacterial staining in milk and curd.

Plant diseases

- White rust of crucifers - *Cystopus*
- Late blight of Potato – *Phytopthorainfestens*
- Early blight of Potato – *Alternaria soloni*
- Green ear disease of Bajra – *Sclerosporagraminicola*
- Red spot of sugarcane- *Colletorichumfulcatum*
- Field study of plants in farmers field/agricultural stations

Suggested Books:

1. Bilgrami, K.S. and Dube H.C. A text book of modern Plant Pathology, New Delhi, 2000
2. Biswas S.B. and Biswas A. An introduction to viruses, Vikas Publication house, New Delhi, 2000.
3. Palzar M.J. Microbiology, McGraw Hill Edu. Pvt. Ltd. London, 2001.

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4. Sharma P.D. Microbiology and pathology, Rastogi Publication, Meerut, 2003.
5. Agrios G.N. Plant Pathology fifth edition, Elsevier, 2006.

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40-A

5. MATHEMATICS (HONS.)
B.Sc. (Hons) Part –II

Teaching : 3 hours per week per Theory paper.

2 Hours per Week for Practical

Examination:

	Min. Pass Marks		Max. Marks
Scheme: Science – 160			400
		Duration	Max.Marks
Paper – V Real Analysis		3 hrs.	85
Paper – VI Differential Equations		3 hrs.	85
Paper – VII Numerical Analysis and Vector Calculus		3 hrs.	85
Paper – VIII Operations Research		3 hrs.	85
Practical:		2 hrs.	60

Note:

1. Common paper will be set for both the Faculties of Social Science and Science. However, the marks obtained by the candidate in the case of Faculty of Social Science will be converted according to the ratio of the maximum marks of the papers in the two Faculties.

2. Each candidate is required to appear in the Practical examination to be conducted by internal and external examiners. External examiner will be appointed by the University and internal examiner will be appointed by the Principal in consultation with Local Head/Head, Department of Mathematics in the college.

3. An Internal/external examiner can conduct Practical Examination not more than **100 (Hundred)** candidates.

4. Each candidate has to pass in Theory and Practical examinations separately.

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Paper – V: Real Analysis

Teaching : 3 Hours per Week

Duration of Examination : 3 Hours   **Max. Marks: 85**

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Real numbers as complete ordered field, Limit point, Bolzano-Weierstrass theorem, closed and Open sets. Concept of compactness and connectedness. Heine-Borel theorem. Holder inequality & Minkowski inequality, Metric space – Definition and examples, Open and Closed sets, Interior and Closure of a set, Limit point of a set in metric space.

Unit 2: Real sequences- Limit and Convergence of a sequence, Monotonic sequences. Cauchy's sequences, Subsequences, Cauchy's general principle of convergence. Properties of continuous functions on closed intervals.

Unit 3: Properties of derivable functions, Darboux's and Rolle's theorem. Notion of limit, continuity and differentiability for functions of several variables. The directional derivative, the total derivative, expression of total derivative in terms of partial derivatives.

Unit 4: Riemann integration – Lower and Upper Riemann integrals, Riemann integrability, Mean value theorem of integral calculus, Fundamental theorem of integral calculus. Functions of bounded variations. Introduction, properties of functions of bounded variations, total variation.

Unit 5: Sequence and series of functions – Pointwise and Uniform convergence, Cauchy's criterion, Weierstrass M-test, Abel's test, Dirichlet's test for uniform convergence of series of functions, Uniform convergence and Continuity of series of functions, Term by term differentiation and integration.

Reference Books:

1. K.A. Ross, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

2. R.G. Bartle D.R. Sherbert, Introduction to Real Analysis (3rd edition), John Wiley and Sons (Asia) Pvt. Ltd.., Singapore, 2002.

3. Charles G. Denlinger, Elements of Real Analysis, Jones and Bartlett (Student Edition),2011.

4. S. Kumaresan, Topology of Metric Spaces, Narosa Publishing House, Second Edition 2011.

5. G. F. Simmons, Introduction to Topology and Modern Analysis, Mcgraw-Hill, Edition 2004.

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Paper – VI: Differential Equations

Teaching : 3 Hours per Week
Duration of Examination : 3 Hours   **Max. Marks: 85**

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Degree and order of a differential equation. Equations of first order and first degree. Equations in which the variables are separable. Homogeneous equations and equations reducible to homogeneous form. Linear equations and equations reducible to linear form. Exact differential equations and equations which can be made exact.

Unit 2: First order but higher degree differential equations solvable for x,y and p. Clairaut's form and singular solutions with Extraneous Loci. Linear differential equations with constant coefficients, Complimentary function and Particular integral.

Unit 3: Homogeneous linear differential equations, Simultaneous differential equations. Exact linear differential equations of nth order. Existence and uniqueness theorem.

Unit 4 : Linear differential equations of second order. Linear independence of solutions. Solution by transformation of the equation by changing the dependent variable/the independent variable, Factorization of operators, Method of variation of parameters, Method of undetermined coefficients.

Unit 5: Partial differential equations of the first order. Lagrange's linear equation. Charpit's general method of solution. Homogeneous and non-homogeneous linear partial differential equations with constant coefficients. Equations reducible to equations with constant coefficients.

Reference Books:

1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Co., 2003.
2. M.Ray, A Text Book on Differential Equations, Students and Friends Co., Agra,1998.
3. E.A. Codington, An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961.
4. R.S. Senger, Ordinary Differential Equations with Integration, Prayal Publ. 2000.
5. D.A. Murray, Introductory Course in Differential Equations, Orient Longman (India), 1967.
6. Frank Ayres, Theory and Problems of Differential Equations, TMH, 2002.
7. I.N. Snedon, Elements of Partial Differential Equations, TMH, 2001.

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Paper – VII: Numerical Analysis and Vector Calculus

Teaching : 3 Hours per Week

Duration of Examination : 3 Hours   **Max. Marks: 85**

Note: (i) This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

(ii) Non-Programmable Scientific Calculators are allowed.

Unit 1: Differences. Relation between differences and derivatives. Differences of a polynomial. Newton's formulae for forward and backward interpolation. Divided differences. Newton's divided difference, Lagrange's interpolation formula.

Unit 2: Central differences.Gauss's, Stirling's and Bessel's interpolation formulae. Numerical Differentiation. Derivatives from interpolation formulae. Numerical integration, Derivations of general quadrature formulas, Trapazoidal rule. Simpson's one-third, Simpson's three-eighth and Gauss's quadrature formulae.

Unit 3: Relation between the roots and coefficients of general polynomial equation in one variable, transformation of equations, Descarte's rule of signs, solution of cubic equations by Cardon's method, biquadratic equations by Ferari's method.
Numerical solution of Algebraic and Transcendental equations, Bisection method, secant method, Regula-Falsi method, Iteration method, Newton- Raphson Method (derivation of formulae and rate of convergence only).

Unit 4: Gauss elimination and Iterative methods (Jacobi and Gauss Seidal) for solving system of linear algebraic equations. Partial Pivoting method, ill conditioned systems, Numerical solutions of ordinary differential equations of first order with initial condition using Picard's, Euler and modified Euler's method.

Unit 5: Scalar and Vector point functions. Differentiation and integration of vector point functions. Directional derivative. Differential operators. Gradient, Divergence and Curl. Theorems of Gauss, Green, Stokes (without proof) and problems based on these theorems.

Reference Books:

1. H.C. Saxena, Calculus of Finite Differences and Numerical Analysis, S.Chand & Co., N.D., 1986.
2. Shanti Narayan and J.N. Kapur, A Text Book of Vector Calculus, S.Chand, 1966.
3. Murray R. Spiegel, Vector Analysis, McGraw-Hill, 1959.
4. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
5. C. F. Gerald and P. O. Wheatley, Applied Numerical Analysis, Pearson Education, India,7th edition, 2008.
6. C.F. Gerald, P.O. Wheatley, Applied Numerical Analysis, Addison-Wesley, 1998.

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Paper – VIII: Operations Research

Teaching : 3 Hours per Week

Duration of Examination : 3 Hours   **Max. Marks: 85**

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Theory of Games – Introduction, Basic definitions, Minimax (Maximin) criterion and Optimal strategy, Saddle point, Minimax-Maximin principle for mixed strategy games, Fundamental theorem of Game theory. Two-by-two games without saddle point, Arithmetic method for 2x2 games. Graphical method for 2x2 games.

Unit 2: Inventory Models – Definition, Types of inventory models, Classification of inventory models, Economic ordering quantity (EOQ), EOQ models without shortage, EOQ models with shortage, EOQ models with constraints.

Unit 3: Probability theory – Probability distributions of a random variable, Standard deviation, Variance, Mathematical expectation, Binomial, Poisson and Normal distributions.

Unit 4: Queueing Theory – Introduction, Probability distributions in queueing systems. Models-Erlang model, general Erlang model, Model III(M/M/I): (N/FCFS).

Unit 5; Sequening Models: Sequening problems, processing n jobs through two machines. Processing n jobs through three machines, processing two jobs through m machines and processing n jobs through shortest cyclic Route Models. Minimal path problem (shortest Acyclic Route Models).

Reference Books:

1. J.K. Sharma, Operation research- Theory and Application, Macmillan Pub.India Ltd.
2. Kanti Swaroop, P.K.Gupta and Manmohan, Operation Research, Sultan Chand & . Chand & Co., N.D., 2007.
3. S.D.Sharma, Operations Research, Kedar Nath Ram NAth and co. Meerut, 2005.
4. F. S. Hillier and G. J. Lieberman, Introduction to Operations ResearchConcepts and Cases (9th Edition), Tata McGraw Hill, 2010.
5. Hamdy A. Taha, Operations Research, An Introduction (9th edition), Prentice-Hall, 2010.
6. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.

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Practical

Teaching: 2 hours per week per batch not more than 20 students.

Examination: **Duration: 2 Hours**

Scheme

Max.Marks   60

Min.Pass Marks   22

Distribution of Marks :

Two Practicals one from each group

20 Marks each	=	40 Marks
Practical Record	=	10 Marks
Viva-voce	=	10 Marks
Total Marks	=	60 Marks

The paper will contain TWO practicals. The candidates are required to attempt both practicals.

Practicals with Computer Programming in C Language.

Programming languages and problem 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.

Group A :

1. Printing n terms of Fibonacci sequence.
2. Finding $n!$, $\sum n, \sum n^2$ etc.
3. Defining a function and finding sum of n terms of a series/sequence whose general term is given (e.g. $a_n = \frac{n^2+3}{n+1}$).
4. Printing Pascal's triangle.
5. Finding gcd and lcm of two numbers by Euclid's algorithm.
6. Checking prime/composite number.
7. Finding number of primes less than n, $n \in Z$.
8. Finding mean, standard deviation and ^nP_r, ^nC_r for different n and r.

Group B:

1. Numerical integration using Trapezoidal, Simpson's 1/3, 3/8 and Waddle rules.

Note:

1.   Each Candidate (Regular/non-Collegiate) has to prepare his/her practical record.

2.   Each Candidate has to pass in Practical and Theory examinations separately.

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6. PSYCHOLOGY (HONS.)
B.Sc. Honours Part-II

SCHEME OF EXAMINATION:

Papers	Nomenclature	Duration	Max. Marks	Min. Pass Marks
Paper-V	Systems and Theories of Psychology	3 Hrs.	75	
Paper-VI	Abnormal Psychology	3 Hrs.	75	
Paper-VII	Counselling Psychology	3 Hrs.	75	120
Paper-VIII	Biological Basis of Behaviour	3 Hrs.	75	
	Practical	3 Hrs.	100	40

NOTE :-

1. There will be 4 Theory Papers in Psychology in B.A. Honours Part-II. Each paper will be of 3 hours. There will be a common paper for Arts and Science. There will be 3 Sections A, B and C in all the papers and will cover the entire course content of the paper.

Section-A   will contain 10 questions of 20 words consisting of 1.5 marks each. Thus, Part-A will be of 15 marks.

Section-B   will contain 7 questions of 50 words each, out of which students are required to attempt 5 questions. Each question will be of 3 marks. Thus, Part-B will be of 15 marks.

Section-C   will contain 3 long questions each with internal choice. Each question will be of 15 marks.

Thus, Part-C will be of 45 marks.

For clarification the distribution of marks is tabulated as below:-

B.A. Honours(Psychology)Part-II			
Section	No. of Questions	Marks	Total
A	10	1.5	15
B	5 (Out of 7)	03	15
C	3 (with internal choice)	15	45
		Total Marks	75

2. Use of simple calculator will be allowed for statistical portions of all papers.

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Paper V - Systems and Theories of Psychology

Section-A

1. Psychological Foundations: Helmholtz, Weber and Fechner.
2. Structuralism: Wundt and Titchner.
3. Functionalism: William James, Galton and Cattell

Section-B

4. Behaviorism: Thorndike, Pavlov, Watson and Tolman
5. Gestalt Psychology: Wetheimer, Koffka and Kohler.
6. Dynamic Psychology: Mc Dougall and Woodworth.

Section-C

7. Psychoanalysis: Freud, Jung and Adler
8. Neo Freudians: Horney, Fromm, Sullivan and Erikson
9. Humanistic Psychology: Rogers and Maslow
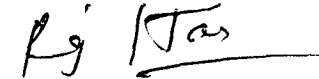
Books Recommended :

- Hergenhahr, B.R. (2001).*An Introduction to the History of Psychology*. New Delhi: Cengage Learning.

- Leahey, T.H. (2006). *History of Psychology: Main Currents in Psychological thoughts*. New Delhi: Pearson Education.

- Shultz, D.P. (2003). *History of Psychology*. New Delhi: Pearson Education.

- Singh, A.K. (1997). *The Comprehensive History of Psychology*. New Delhi: Motilal Banarsi Das.

Paper VI – Abnormal Psychology
Section-A

1. Mental Disorder :Defination, Indicators of Abnormality, Different Models and Classification. Formal and Diagnostic Classification. DSM-5 and ICD-10 Classification Systems, Mental Health Professionals.

2. Causal Factors : Risk Factors and Causes : Necessary, Sufficient and Contributory causes; Diathesis-Stress Models. Theoretical Perspectives : Biological, Psychological, Psychodynamic, Behavioral, Cognitive Behavioral, Humanistic & Existential, Social, Cultural, Electic and Biopsychological Approach

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3. Clinical Assessment and Diagnosis : Baisc Elements in Assessment, Social or Behavioral History; Physical, Neurological, Neuropsychological, Psychosocial Assessment. Ethical Issues in Assessment

Section-B

4. Anxiety, Obsessive Compulsive and Trauma Stressor related Disorders : Types, Clinical Picture and Causal Factors.

5. Mood Disorders and Eating Disorders : Types, Clinical Picture and Causal Factors .

6. Somatic Symptoms and Dissociative Disorders : Types, Clinical Picture and Causal Factors.

Section-C

7. Personality Disorders : Types, Clinical Picture and Causal Factors.

8. Schizophrenia and Other Psychotic Disorders : Types, Clinical Picture and Causal Factors.

9. Psychological Treatment/Therapies : Behavioral Therapy, Cognitive and Congnitive-Behavioral Therapy, Humanistic & Existential Therapy, Psychodynamic Therapy, Couples and Family Therapy, Eclecticism and Integrated Approaches.

Books Recommended :

- Butcher, J.N., Hooley, J.M. & Mineka, S. (2017). Abnormal Psychology. Noida : Pearson India Education.
- Oltmanns, T.F. & Emery, R.E. (2017). Abnormal Psychology. Noida : Pearson India Education.
- David, B.H. & Durand, V.M. (2007). Abnormal Psychology. New Delhi : Thomson.
- Ray, W.J. (2015), Abnormal Psychology, New Delhi; Sage.

Paper VII - Counselling Psychology
Section-A

10. Introduction: Meaning, Purpose and Goals; History and Current Trends in Counselling.

11. Counselling Process and Counselling Relationships: Nature and Determinants; Steps of Counselling

    Process; Initial Interview: Types and Conduction, Exploration and the Identification of Goals.

12. Personal and Professional Aspects: Personality and Background of the Counsellor; Professional

    Counselling - related activities; Ethical and legal aspects: Ethics, morality, law, and Counselling, Professional Codes of Ethics and Standards; Ethical decisions.

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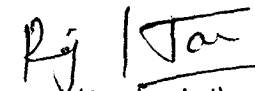University of Rajasthan
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Section-B

4. Psychoanalytical and Psychodynamic Approach: Freudian, Neo-Freudian and Modern.

5. Humanistic Approach: Existential and Client-centered.

6. Cognitive and Behavioural Approach: Rational Emotive, Transaction Analysis and Behavour Modification.

Section-C

7. Counselling with Diverse Populations: Aged Populations, Gender-based Counselling, Group Counselling and Crisis Intervention Counselling.

8. Counselling in a Multicultural Society: Counselling across Culture and Ethnicity, History of Multicultural Counselling, Issues in Multicultural Counselling, Counselling with specific Cultural groups.

9. Career Counselling over the Life Span: Importance of Career Counselling, Scope of Career Counselling and Careers, Career Information, Career Counselling with Diverse Populations.

Books Recommended :

- Gladding, S.T. & Batra, P. (2018). *Counselling A Comprehensive Profession*. New Delhi: Pearson Publication.

- Gibson, R.L. & Mitchell, M.H. (2005). *Introduction to Counselling and Guidance*. New Delhi: Pearson India Education.

- George, R.L. & Cristiani, T.S. (1994). *Counselling Theory and Practice*. New Delhi: Prentice – Hall.

- Gelso, C.G. & Fretz, B. (2007). *Counselling Psychology; Practices, Issues and Interventions*. New Delhi: Cengage learning.

- Capuzzi, S. (2008). *Counselling and Psychotherapy*. New Delhi: Pearson Education.

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Paper VIII - Biological Basis of Behaviour

Section-A

1. Introduction: Definition, Scope and Methods of studying Biological basis of Behaviour.

2. Cells of Nervous system: Structure and Functions; Communication within a Neuron, Communication between Neurons.

3. Structure and Functions of Nervous System: Central Nervous System and Peripheral Nervous

   System: Basic features and Functions; Neurotransmitters.

Section-B

4. Lateralization of Brain Functions: Difference between Left and Right Hemispheres, Cortical localization of Language, Aphasia.

5. Ingestive Behavior: Physiological Regulatory mechanism; Brain mechanism in Eating and Eating Disorders.

6. Sleep and Waking: Physiological mechanism of Sleep and Waking; Biological Clock and Sleep Disorders.

Section-C

7. Learning and Memory: Neural Mechanism of learning and Memory, Disorders of Memory.

8. Emotion, Stress and Health: Neural Mechanism of Fear, Anger and Aggression; Stress and Health; Hormones and Emotion.

9. Developmental Disorders: Genetic and Neurological basis for Autism, ADHD, Mental Retardation.

Books Recommended :

- Carlson, N.R. (2007). *Foundations of Physiological psychology*. New Delhi: Pearson Education.
- Pinel, J.P. (2007). *Biopsychology*. Delhi: Pearson Education.
- Levinthal, C.F. (1996). *Introduction to physiological Psychology*. New Delhi: Prentice Hall.

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Practical

1. Method of Average Error- Muller Lyer Illusion

2. Biofeedback

3. Experiment on Classical Conditioning

4. Measurement of Emotions by Facial Expression

5. Word Association Test

6. High School Personality Questionnaire

7. Thematic Apperception Test

8. Level of Aspiration

9. Wechsler Adult Intelligence Scale

10. Neuropsychological Assessment

11. Assessment of Mental Heath

12. PGI Battery of Memory Dysfunction

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7. Geography
Scheme of Examination

Notes

1. Students are permitted to use the stencils, simple calculator and log tables wherever needed in both theory and practical examinations.

2. There will be a common paper for Arts and Science.

3. Q.1 will be compulsory and will cover the entire course of the paper
   Q.No. 1 of 20% marks of the maximum marks be set in two parts.
   (a) Part (a) will have ten items for locating on a map (to be supplied by examination centre) carrying 10% marks of the maximum marks and candidates shall attempt any five items.
   (b) Part (b) will have 10 short answer questions carrying 10% marks of the maximum marks and candidates shall attempt any five items.

4. Remaining 9 questions carrying equal marks will be set with three questions from each section of the syllabus.

5. Candidate will attempt 5 questions including question No. 1 in all selecting at least one question from each section.

6. Practical examination will be conducted by the board of examiners.

7. The candidate will have to pass in theory and practical separately.

SYLLABUS
Paper V: Introduction to Political Geography

Section A

Meaning, nature, scope and subject matter of political geography, political geography and critical geopolitical approaches to the study of political geography, morphology of the

and united field theory, role of physical, demographic, economic, socio-cultural and historical factors in the emergence of states.

Section B

State as a politico-territorial phenomenon: changing nature of location, size and shape in political geography of states, political and administrative framework and its hierarchical relationship to unitary and federal forms of governance, boundaries and frontiers, functions and classification of international boundaries, global strategic views: the views of Mackinder spykman, de Seversky and mahan and their relevance to contemporary world situation.

Section C

Underdevelopment and international policies, the North-South dialogue, SAARC and ASEAN the new international economic order, international tensions, West Asia and Indian Ocean region, regionalism in international relations, geopolitical dimensions of environment.

Recommended Readings :

Adhikari, S. 2004: Political Geography, Rawat Publications, Jaipur
Alexander, L. M. 1966: World Political Patterns. John Murray and Co., London
Blij, H.J. de and Glassner, Martin 1968 Systematic Political Geography. John Willey, New York.
Dikshit, R.D. 1985: Political Geography: A Contemporary Perspective. Tata McGraw-Hill Publishing Co., New Delhi.
East, W.G. and Spate, O.H.K. 1966: The Changing Map of Asia. Methuen, London.
Pounds, N.J.G. 1972: Political Geography. McGraw Hill, New York.
Short, J.R. 1992 Political Geography of the 20th Centaury: A Global Analysis. New York.
सक्सेना, एच.एम. 2009-10: राजनैतिक भूगोल, रस्तोगी पब्लिकेशन्स, मेरठ |
Taylor, P. 1985. Political Geography. Longman, London

Paper VI: Cultural Geography

Section A

Definition, components of culture evolution and branches of cultural geography, cultural realms convergence and divergence process, cultural diversity in world, evolution of man, rise and dominance of homosapiens, their pattern of spread over the globe, primary races and their relationship with surrounding environment landscape ecology.

Section B

Evolution of civilization: with special reference to mesopotamian, nile, indus and nwang-..
valley civilization, Indus valley civilization- development, growth, expansion, organization
and causes for its downfall, characteristics and distribution of races, ethnic groups, linguistic
families, religious groups.

Section C

Domestication of plants and animals, patterns of livelihood: various economic activities &
cultural adaptations, agriculture, industrialization and modernization, technological changes
and their spatial implications, social structure and technology, pattern of rural and urban
society, social processes in the city, the city in the developing countries.

Recommended Readings :

Broek, J.C. and Webb, J.W. 1978: A Geography of Mankind. McGraw Hill, New York.
दीक्षित, श्रीकान्त एवं त्रिपाठी, रामदेव 2001 : सांस्कृतिक भूगोल। वसुन्धरा प्रकाशन, गोरखपुर।
Husain, M. 2007, Models in Geography. Rawat Publications, Jaipur
Johnson, D. et al 2012: World Regional Geography: A Development Approach. PHI
Learning Private Limited, New Delhi, Edition
Mukherjee, A.B. and Aijazuddin, A. 198 . India-Culture, Society and Economy. Inter-India
Publication, New Delhi.
प्रसाद, गायत्री 2005 : सांस्कृतिक भूगोल। शारदा पुस्तक भवन, इलाहाबाद।
Rubenstein, J.M. and Bacon, R.S. 1990: The Cultural Landscape: An introduction to Human
Geography. Prentice Hall of India Private Limited, New Delhi
Spencer, J.E. et al : Cultural Geography. John Wiley and Sons, New York.
रिजवी, एस.ए.* 1994: सांस्कृतिक भूगोल। राजस्थान हिन्दी ग्रंथ अकादमी, जयपुर।

Paper VII: Fundamentals of Biogeography

Section A

Definition, scope and significance of bio-geography, basic ecological principles: bio-energy
cycle in the terrestrial ecosystem and energy budget of the earth; trophic and food chain
drawin's theory of evolution, concept of biome and community

Section B

Origin of flora and flora geographical classification, major genera, classification of
plants and animals and their dispersal, distribution of plant life on the earth and its relation

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soil types climates and human practices, geographical distribution of animal life on the earth and its relations to soil, vegetation types, climates and human practices

Section C

Ecological changes over space and time, ecosystem stability and disturbance, managed ecosystems : agricultural, urban, case studies of human induced ecological changes: desert ecosystems with specific reference to Rajasthan, wetland ecosystems with specific reference to the Rajasthan wethlands, agricultural ecosystems with specific reference to the Indira Gandhi Nahar Pariyojna (IGNP), industrial affluent and its effect on fresh water biology and riverine ecosystem management practice (special reference to Rajasthan).

Recommended Readings :

Cox, C.B. Moore, P.D. 2010: Biogeography- An Ecological and Evolutionary Approach. Johnwiley and Sous, U.S.A.

Huggett, R.J. 1998: Fundamental of Biogeography. Routledge, London.

Ladle, R.J. and Whittaker, R.J. 2011. Conservation Biology. Blackwell Publications Co., U.S.A.

Mathur, H.S. 1988: Essentials of Biogeography. Pointer Publishers, Jaipur.

Macdonald, Geen, 2002: Biogeography: Introduction to Space-Time and Life. John Wiley, New York

Odum, E.P. 1975: Ecology, Rowman and Littlefield. Lanhan, U.S.A.

Robinson,H. 1982:Biogeography. Eles,Mc Donald and Evans London.

Singh, M.B. et al (ed.) 1986: Forest Resource Economy and Environment. Concept Publishing Company, New Delhi.

Singh, S. 2012: Environmental Geography. Prayag Pustak Bhawan, Allahabad.

सिंह, एस. 2012: जैव भूगोल। प्रयाग पुस्तक भवन, इलाहाबाद।

Paper VIII: Statistical Methods In Geography

Section A

Sources of data methods of data collection, processing analysis and results, questionnaire and schedule, frequency distributions, characteristics of frequency distribution: number of classes: class-interval, graphical representation data: histogram, frequency polygon, frequency curve and cumulative frequency curve (ogive).

Section B

Measure of central tendency: median, mode, arithmetic mean and geometric mean, measures of variation: range, mean deviation, standard deviation, coefficient of variation, measure of skewness, sample correlation and regression.

Section-C

Theory of probability-basic principles: axioms probability: probability distribution, theory of sampling: types of sampling random systematic and stratified sampling: problems application of sampling methods in Geography t-test and chi-square test.

Books Recommended

Aslam, Mahmood 1977: Statistical Methods in Geographical Studies. Rajesh Publications, Delhi.

Duncan, O.D. et. Al. 1961: Statistical Geography, (Problems in Analysing Areal Data). Free Press of Blenco, New York.

Gregory S. 1963: Statistical Methods and the Geographer. Longmans, London.

King, L.J.: Statistical Analysis in Geography. Prentice Hall, Englewood Clifs, NJ.

Lewis, Peter 1977: Maps and Statistics. Methuen & Co. Ltd., London.

Gupta, S.P. 1979: Statistical Methods. Sultan Chand & Sons, New Delhi.

Mahmood, A. 1998: Statistical Methods in Geographical Studies. Rajesh Publication, New Delhi.

Nagar, K.N. 1992: Sankhiki Ke Mool Tatva. Meenakshi Prakashan, Meerut.

Practicals

Scheme of examination

Min. Pass Marks: 32

Max Marks 80

	Marks	Time
Written test	40	3 hrs.
Field survey and viva voce	15+5	2½ hrs.
Record and viva voce	15+5	
Total Marks	80	

N.B. 1. There shall be 6 questions in written test selecting at least two questions from each section. Candidates are required to attempt 3 questions selecting 1 question from each section. All question carry equal marks.

SYLLABUS

Section A

Maps and diagrams: one dimensional (bar & pyramid), two dimensional (square, rectangle wheel, circles & ring), three dimensional diagrams (cube, sphere and block pile), distributional maps dot, isopleth, choropleth, chromatic and non-chromatic

Section B

Measures of central tendency & dispersion: mean, median and mode. mean deviation, quartiles & standard deviation

Section C

Plane table surveying: Equipments, procedure, traversing – open and closed traverse, methods- radial and intersection, concept of resectioning: two point problem, three point problem

Use of Indian pattern clinometer.

Recommended Readings:

Monkhouse F.J. and Wilkinson, H.R. (1971), Maps and Diagrams: Their Compilation and Construction. B.I. Publications Private Limited. New Delhi.

Singh R.L. and Singh R.P.B. (1991), Elements of Practial Geography. Kalyani Pub. New Delhi.

Sarkar A. (1997); Practical Geography: A Systematic Approach. Orient Longman. Ltd. Hyderbad.

Robison, A.H. et al 2004: Elements of Cartography. John Willey & Sons, New York

शर्मा, जे.पी. 2012: प्रायोगिक भूगोल। रस्तोगी पब्लिकेशन्स, मेरठ।

Mishra, R. and Ramesh, A (1989); Fundamentals of Cartography. Concept Publishing Company, 1989. New Delhi.