



**University of Rajasthan**  
**Jaipur**

**SYLLABUS**

**B.Sc. (HONS)**

**PART-II**

**2015**

Psychology

B.Sc. Hons Pt II

2013 Exam

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

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## 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 with 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.



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**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 interface. 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.

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**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 coefficients. 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 :

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- (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, Hermitian 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  $3 \times 3$  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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**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 Schrödinger 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.

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*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- $\pi$  inter-conversions, open, short and characteristic impedance of symmetric T- $\pi$  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 emitter 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 impedance (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.

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**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, Colpitts, 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. Boolean Algebra De Morgan'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 Valkenburg : 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 thermodynamic constant  $\gamma$  (gamma) =  $C_p/C_v$  using elements and Desormes method.
3. Determine thermal conductivity of a bad conductor 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 temperature.
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  $\pi$  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.

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## 2. CHEMISTRY (HONS.)

## Scheme :

Four Theory Papers	Duration	Max. Marks	Min. Pass Marks
Paper-V : Inorganic	3 hrs.	75	
Paper-VI : Organic	3 hrs.	75	120
Paper-VII : Physical	3 hrs.	75	
Paper-VIII : Analytical	3 hrs.	75	
Practicals		100	40

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.

## B.Sc. (Hons) PART-II

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  $\mu_s$  and  $\mu_{\text{off}}$  values, orbital contribution of magnetic moments, application of magnetic moment data for 3-d 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, John-Teller effect.

(b) 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.

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**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  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  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 ionic radii, lanthanide contraction, magnetic properties, complex formation, 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, principles involved in the extraction of the elements.

**Acids and bases**

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system 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 and hardness and softness.

**Nonaqueous solvents**

Physical properties of a solvent, types of solvents and their

general characteristics, reactions in non-aqueous solvents with reference to liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$ .

**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 [ $\text{Pb}(\text{OAc})_4$  and  $\text{HIO}_4$ ] and pinacol-pinacolone rearrangement.

**Trihydric alcohols** : Nomenclature and methods of formation, 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 rearrangement, 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 autoxidation, 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 benzophenone.

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

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones. MPV, Clemmensen, Wolff-Kishner,  $\text{LiAlH}_4$  and  $\text{NaBH}_4$  reductions. Halogenation of enolizable ketones.

An introduction to  $\alpha$ ,  $\beta$  unsaturated aldehydes and ketones. Preparation and properties of acrolein, crotonaldehyde and vinyl methyl ketone, Michael reaction.

Acidity of  $\alpha$ -hydrogen, alkylation of diethyl malonate and ethyl acetoacetate (EAA). Synthesis of EAA : The Claisen condensation, keto-enol tautomerism of 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  $\alpha$ ,  $\beta$  and  $\gamma$ -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 (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

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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 of nitroalkanes, 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 amines. 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. Reactions of amines.

**Aryl diazonium salts** : Preparation and synthetic transformations, azo coupling. Diazomethane.

#### UNIT-V

##### NMR 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

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**Electrochemistry**

(a) Electrolyte 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.

Interionic attraction theory, quantitative treatment of theory of strong electrolytes, verification of the Debye Hückel Onsager equation, Activity Coefficient and ionic strength.

(b) Transference numbers and their determination by

- (1) Hittorf's method
- (2) Moving boundary method Abnormal transference numbers.

**UNIT-II****Thermodynamics**

Limitations of First law of thermodynamics. Spontaneous processes. Second law 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 significances 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.

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Ultraviolet and visible spectroscopy having absorption interaction. Chromophores and auxochromes. Determination of wavelength (max) and molar extinction coefficient of compound. Bathochromic and hypsochromic shifts. Colours in complexes. Applications of uv-visible spectroscopy, Electronic spectra. Modes of vibrations in diatomic, linear and non-linear polyatomic 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 Compton effect.

Limitations of Bohr Models, Heisenberg uncertainty principle, wave nature of electron, De Broglie wave equation and its experimental verifications. Operators and their applications.

Sinusoidal wave motion, derivation of Schrodinger's wave equation. Physical significance of  $\psi$  (psi) and  $\psi^2$  (psi)<sup>2</sup>. Eigenvalues and Eigen functions. Characteristics of wave functions.

Normalization and orthogonality of wave functions. Solution of Schrodinger wave equation. Particle in one Dimensional box.

#### UNIT-V

##### Photochemistry

Absorption of light. Grotthuss Draper 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 monochloroacetic acid.

Consequences of light absorption phosphorescence, fluorescence, chemiluminescence & 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

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transmutation of elements, Fundamental particles, Positron, antiproton, antineutron, neutrins and antineutrins.

**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) Radio carbon dating
- (2) Reaction mechanism
- (3) Biology & medicine

**Recommended books for references**

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**

#### UNIT-I

**1. 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 and cations.

**2. 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

**1. 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.

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**2. 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

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

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

### Unit-IV

**1. Flame emission and Atomic absorption spectrometry:** Elementary theory, instrumentation. Nebulization, flames and flame temperatures, interferences, flame spectrometric techniques.

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

### UNIT-V

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

## CHEMISTRY PRACTICAL

8 Hours per week (Spread over Four days)

### Inorganic Chemistry

(i) Quantitative (Gravimetric) (any Five)

Estimation of Barium (as sulphate)

Lead (as chromate)

Copper (as Cuprous thiocyanate)

Nickel (as dimethyl glyoximate)

Silver (as chloride)

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Zinc (as Zinc Amm. Phospate)

Magnesium (as Magnesium hydrogen phosphate,  $MgHPO_4$ )

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

- (a) Chloropentamminecobalt(III) chloride.
- (b) Carbonatotetramminecobalt(III) chloride.
- (c) Pyridine complex of copper.
- (d) Copper tetrammine complex.
- (e) Mercury tetrathiocyanatocobaltate.
- (f) Hexaamminenickel(II) chloride.

#### Organic Chemistry

##### Exercises

**(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-bromo acetanilide.
- (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 performed not less than one from each Unit.

**(A) Chemical Dynamics experiments :**

1. To find the velocity constant of the hydrolysis of methyl acetate catalyzed by an acid.

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2. To determine the order of saponification of ethyl acetate by NaOH.
3. To find out the rate constant and order of reaction between potassium persulphate and potassium iodide,
4. To study the reaction between acetone and iodine.
- (B) 5. Determination of transition temperature by thermometric method and dilatometric method.
- (C) 6. 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.
- (D) 7. Conductometric titrations.
  - (a) To find out the strength of strong acid by titrating it against a strong alkali.
  - (b) To find out strength of weak acid by titrating it against a strong alkali.
  - (c) To find out strength of hydrochloric acid and acetic and in a mixture of both, by titrating it against sodium hydroxide.
8. Determination of equivalent conductivity of electrolyte at different dilutions.

**Instructions to the Examiners**

**Practical Examination: 7 hrs duration**

**100 Marks**

(Completed in one clay)

1. Quantitative : Gravimetric exercise	18
2. Inorganic Preparation	12
3. Identification of simple organic compounds & preparation of its suitable derivative	15
4. Organic Preparation	10
5. Physical Chemistry Practical (Perform one of the physical Chemistry experiment mentioned in the syllabus)	25
6. Viva	10
7. Record	10

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**3. ZOOLOGY**

Paper-VII	Animal Diversity-3	50 Marks
Paper-VIII	Animal Diversity-4	50 Marks
Paper-IX	Physiology-I	50 Marks
Paper-X	Physiology-2	50 Marks
Paper-XI	Immunology -	50 Marks
Paper-XII	Ethology	50 Marks
Practicals	2 days (10 Hrs.)	100 Marks

Seminars, Posters, models, visits, reports, practical record etc. will carry internal marking of 20 marks which will be added in the Practicals (Total=80+20=100)

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

Paper-VII : Animal Diversity-3 Max. Marks : 50

**Scheme of Examination :**

1. There will be 5 questions in each paper. All questions are compulsory and carry equal marks.
2. Question No. 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Question should be evenly distributed covering entire syllabus.
3. Each paper is divided in to four units/sections. There will be one question from each unit/section. The question No. 2 to 5 will have internal choice.

**Section-A**

1. Origin and general characteristics of chordates.
2. Protochordates—Classification upto orders Inter relationships, structural organisation of Hemichordates, Urochordates, and Cephalochordates.
3. Agnatha—Classification upto orders.

**Section-B**

4. Fishes—Classification upto orders, parental care, respiratory organs, migration.
5. Pisciculture

**Section-C**

6. Amphibians—Origin and evolution of land vertebrates, classification upto orders, parental care.

**Section-D**

7. Reptiles—Classification upto orders, extinct reptiles, poisonous and nonpoisonous snakes of India.

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**Paper-VIII : Animal Diversity-4**

**Max. Marks : 50**

**Scheme of Examination :**

1. There will be 5 questions in each paper. All questions are compulsory and carry equal marks.
2. Question No. 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Question should be evenly distributed covering entire syllabus.
3. Each paper is divided in to four units/sections. There will be one question from each unit/section. The question No. 2 to 5 will have internal choice.

**Section-A**

1. Origin of birds. Bird migration. Principles of bird flight.
2. Palaeognathae and Neognathae-Distribution and classification. Beaks and claws.

**Section-B**

3. Poultry Keeping.
4. Mammals-Origin, classification general characters.

**Section-C**

5. Comparative anatomy of systems (Integument. Skeletal system, Digestive system.

**Section-D**

6. Comparative analogy of systems : Circulatory system. Respiratory system, sensory organs, Urinogenital system) of fishes, Amphibians, Reptiles, Aves and mammals.

**Paper-IX : Physiology-I**

**Max. Marks : 50**

**Scheme of Examination :**

1. There will be 5 questions in each paper. All questions are compulsory and carry equal marks.
2. Question No. 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Question should be evenly distributed covering entire syllabus.
3. Each paper is divided in to four units/sections. There will be one question from each unit/section. The question No. 2 to 5 will have internal choice.

**Section-A**

1. Aim and Scope of Physiology—Cell Physiology, mammalian physiology, comparative physiology and applied physiology.

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2. Chemical foundations of physiology—solutions, osmotic pressure, diffusio, pK and pH. buffers.
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 haemoglobin.
5. Heart—Structure, Origin, conduction and regulation of heart beat : cardiac cycle and ECG.
6. Peripheral circulation—Blood pressure, capillary pressure, regulation.

**Section-C**

7. Respiration—Mechanism and control of breathing, concept of partial pressure of gases, Bohr's effect.

**Section-D**

8. Digestion and absorption of dietary components.
9. Nutritional requirements and disorder.

**Paper-X : Physiology-2**

**Max. Marks : 50**

**Scheme of Examination :**

1. There will be 5 questions in each paper. All questions are compulsory and carry equal marks.
2. Question No. 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Question should be evenly distributed covering entire syllabus.
3. Each paper is divided in to four units/sections. There will be one question from each unit/section. The question No. 2 to 5 will have internal choice.

**Section-A**

1. Physiology of Nerve Impulse and Reflex Action : Functional architecture of a neuron, origin and propagation of nerve impulse, synaptic transmission; spinal reflex arc; central control of reflex action.
2. Physiology of Muscle Contraction; Functional architecture of skeletal muscle; chemical and biophysical events during contraction and relaxation of muscle fibers.

(24)

(24)

**Section-B**

3. Types of Endocrine Glands; Their Secretions and Functions. Classification of Hormones. Brief account of structural histology of endocrine glands. Pituitary, adrenal, thyroid, 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 neuron secretion : Hypothalamic control of pituitary function, neuroendocrine and endocrine mechanism of insects.

**Section-D**

6. Thermoregulation : Physiological process. Thermoregulation in Cold & Hot Environments. Thermoregulation in Poikilotherms and Homeotherms.
7. Physiology of High altitude : Acclimatisation and Adaptations. Diseases due to High altitudes.
8. Physiology of Diving (Basic outline) Oxygen toxicity decompression sickness.

**Paper-XI : Immunology**

**Max. Marks : 50**

**Scheme of Examination :**

1. There will be 5 questions in each paper. All questions are compulsory and carry equal marks.
2. Question No. 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Question should be evenly distributed covering entire syllabus.
3. Each paper is divided in to four units/sections. There will be one question from each unit/section. The question No. 2 to 5 will have internal choice.

**Section-A**

1. Immunology : Definition, types of immunity-innate and acquired, humoral and cell mediated.
2. Antigen : Antigenicity of molecules haptens.

**Section-B**

3. Antibody : Definition (IgG, IgM, IgD, IgA, and IgE) outline idea of properties and function of each class of immunoglobulin.
4. Antigen : Antibody reactions : Precipitation reaction, agglutination

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reaction, neutralizing reaction, complement and lytic reactions and phagocytosis.

#### Section-C

5. Cells of Immunity : Macrophages, Lymphocytes (B- and T-types) T-Helper cells. T-killer cells, plasma cells, and memory cells.
6. Mechanism of humoral or antibody mediated immunity.

#### Section-D

7. MHC genes and gene products.
8. Immunotolerance, autoimmunity and hypersensitivity Concept.
9. Cytokines.

#### Paper-XII : Ethology

Max. Marks : 50

#### Scheme of Examination :

1. There will be 5 questions in each paper. All questions are compulsory and carry equal marks.
2. Question No. 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Question should be evenly distributed covering entire syllabus.
3. Each paper is divided in to four units/sections. There will be one question from each unit/section. The question No. 2 to 5 will have internal choice.

#### 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. Methods of studying brain and behaviour : Neuroanatomical Neurochemical and Neurophysiological techniques.
4. Feeding strategies among animals.
5. Brain and behaviour.

#### Section-B

6. Genetic and environmental components in the development of behaviour.
7. Communication : Chemical, Visual, Light and Audio.
8. Learning : Habituation, Conditioning. Trial and Error, Latent and Imprinting.
9. Social Behaviour cooperation.

#### Section-C

10. Reproductive behaviour.

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- 10.1 Evolution of sex and reproductive strategies
- 10.2 Mating systems
- 10.3 Courtship
- 10.4 Sexual selection
- 10.5 Parental care
- 11. Biological rhythms
  - 11.1 Circadian and annual rhythms
  - 11.2 Taxes Kineses and navigation
  - 11.3 Migration of fish and birds

**Section-D**

- 12. Learning and memory : Conditioning, Habituation
  - 12.1 Conditioning,
  - 12.2 Habituation,
  - 12.3 Insight learning,
  - 12.4 Association learning,
  - 12.5 Reasoning,
  - 12.6 Cognitive skills
- 13. Wildlife of Rajasthan and behaviour of few wild animals in their habitat and captivity.

**Practical Zoology**

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

Total number of laboratory periods-240

**Note**

- (i) With reference to item 1 the candidate must be well versed with the techniques of flag-labelling and black paper insertion as the case may be for a clear illustration of his/her dissection.
- (ii) With reference to whole mounts and museum specimens in case of unavailability of certain animal, diagram/photograph/model. etc. should be substituted.
- (iii) Candidate will keep a record of all work done in the practical class and it will be submitted for inspection at the time of practical examination.

**I Anatomy :**

- 1. Scoliodon-Afferent, Efferent branchial arteries, cranial nerves, eye muscles and internal ear.
- 2. Labeo-cranial nerves.
- 3. Heteropneustes-Accessory breathing organs.

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4. Dissection of any lizard and bird
  - (i) External features
  - (ii) Digestive system
  - (iii) General viscera
  - (iv) Blood vascular system
  - (v) Urinogenital system
  - B. (i) Hyoid apparatus and columella of lizard.
  - (ii) Air sacs of bird, pecten in bird.
  - C. Neck nerves and ear ossicles of a mammal.
- II Museum Specimens :** Herdmania, Botryllus, Pyrosoma, Salpa, Doliolum, Ammocoete larva, Petromyzon, Amia, Lepidosteus, Hippocampus, Syngnathus, Exocoetus, Echinus, Protopterus, Anguilla, Ichthyophis, Proteus, Necturus, Siren Alytes, Rhacophorus, Chelone, Testudo; Hemidactylus, Varanus, Phrynosoma, Draco, Chameleon, Sphenodon, Mabuya, Eryx, Hydrophis, Naja, Viper, Krait, Crocodilus, Alligator, Gavialis, Archeopteryx, Peacock, Ostrich, Emu, Ornithorynchus, Tachyglossus.  
Didelphis, Kangaroo, Loris, Bat, Manis, Shrew, Monkey.
- III Osteology :** Vertebral column, girdles, limbs and skull of Frog, Varanus, Fowl, and Rabbit.
- IV Study of Permanent Microscopic slides**
  - (i) Amphioxus—T.S. passing through different regions of the body.
  - (ii) Ammocoete larva—T.S. passing through different regions of the body.
  - (iii) Scoliodon—T.S. passing through different regions of the body.
  - (iv) Mammalian histology—Liver, lung, testis, ovary, pancreas, thyroid, parathyroid, adrenal, pituitary. T.S. stomach, T.S. Duodenum, T.S. intestine, T.S. bone and T.S. cartilage.
- V (1) Permanent preparation of the following :**
  - Herdmania—Pharyngeal wall
  - Amphioxus—Oral hood, velum and pharyngeal wall of Amphioxus.
  - Scoliodon—Ampulla of Lorenzini, placoid scales.
  - Labro-Cycloid Scales
  - Frog—Muscle fibre, cartilage.

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**VI. Microtomy procedure : Section cutting (Histological study)**

**VII. Physiology :**

- (i) **Blood** : Haemoglobin, haemoglobin estimation, W.B.C. and RBC counting.
- (ii) **Blood film** : Identification of various types of leucocytes.
- (iii) Demonstration of salivary amylase and catalase (liver) activity.

**VIII. Immunology :**

**Blood groups** : ABO and Rh factor.

**IX. Exercises of Ethology**

1. Food preference in Tribolium.
2. Antennal grooming in Cockroach.
3. Chemical communication among Earthworms.
4. Reaction of Paramecium to dilute acid drop.

**X. Study of evolution of man with the help of models**

**XI.** Educational tour to museum of Natural history, Sea shore and wild life sanctuary, Zoo for collection and on the spot observation of living animals. Students are expected to submit the report of their visit.

**Suggested Readings :**

**Animal Diversity :**

1. Young, J.Z. : The Life of Vertebrates, Oxford University Press, London, 1962 (Low Priced Text Reprint English Language Book Society London, 1962).
2. Colbert. E.H. : Evolution of the Vertebrates, John Wiley & Sons in New York, 1969 (Indian reprint : Wiley Eastern Pvt. Ltd. New Delhi, 1970).
3. Barrington, E.J.W. : The Biology Hemichordata and Protochordata. Oliver & Boyd, London, 1965.
4. Berril, N.J. : The tunicate. The Roy Society, London, 1950.
5. Young J.Z. : The Life of Mammals. Oxford University Press London. 1963.

**Ethology**

6. Manning. An introduction to Behaviour. Edward, Arnold, London.
7. Hindi. R.A., Animal Behaviour. Publication McGraw Hill Co., New York.
8. Animal Societies and Evolution, Scientific American Publications.

9. MacFar Ind D., Animal Behaviour : Publications. ELBS.
10. Werlace, R.A., Animal Behaviour : Goodyear Publishing Co. Inc.
11. Grizimek's Encyclopaedia of Ethology.
12. Hand book of Ethological Method Laharen Publ. Garland STPM Press.
13. Reena Mathur : Animal Behaviour, Rastogi Publications, Meerut.

**Physiology**

14. Vander, A.J., Sheerman, J.H. Luciano, D.S. : Human Physiology. McGraw Hill Publishing Company, New York.
15. Guyton, A.C., Hall, J.H. : Text Book of Medical Physiology. Hascourt Asia, PTE, Ltd.
16. David, R., Burggren, W., French, K. : Eckert Animal Physiology, W.H. Freeman and Company, New York.
17. Hill, R.W., Wyse, G.A., Anderson, M. : Animal Physiology Sinauer Associates, Inc., USA.
18. Sastry, K.V. : Animal Pysiology and Biocemistry Rastogi Publication, Meerut.

**Immunology**

19. Goldsby, R.A., Kindt, T.J., Osborne, B.A. : Kuby Immunology. W.H. Freeman and Company, New York.

**PRACTICAL ZOOLOGY****Scheme of Examination :**

Max. Marks = 100  
 Min. Marks = 36  
 Duration = 8 hrs. (Two days)

**Distribution of marks :**

1. Major Dissection	11
2. Minor Dissection	7
3. Permanent preparation/Microtomy	7
4. Physiology	7
5. Immunology	7
6. Ethology	7
7. Identification and comment upon spots (1 to 8)	24
8. Viva-voce	10
9. Record	10
10. Seminar/Tour report (Internal marking)	10
<b>Total</b>	<b>100</b>

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## 4. BOTANY (HONS.)

## Scheme :

<i>Four Theory Papers</i>	<i>Duration</i>	<i>Max. Marks</i>	<i>Min. Pass Marks</i>
Paper-V	3 hrs.	75	
Paper-VI	3 hrs.	75	120
Paper-VII	3 hrs.	75	
Paper-VIII	3 hrs.	75	
Practicals		100	40

## SCHEME OF EXAMINATION

## Common for all papers

Max. Marks : 75

Time : 3 hrs.

- Two types of question papers of three hours duration for the theory will be applicable. One question paper will comprise the Objective type of questions and the other will comprise of descriptive long answer type questions.
- Descriptive type of question paper (to be given for the first two hours of the examination) will have 6 questions, out of which student is supposed to attempt any 3. This portion of the paper will carry maximum 45 marks.
- The objective type question paper will be given after 2 hours of descriptive type paper and will have 30 questions of the objective type. This portion of the paper will carry 30 marks. The objective type of questions will be of the following types:
  - Multiple choice type questions-20 of 1 mark each.
  - Fill in the blanks/one word/true or false type questions 5 of 1 mark each.
  - Very short answer type questions-5 of 1 mark each.

## Paper V. Biology of Cryptogams

Max Marks. 75

## Unit-I

Time : 3 hrs.

- Algae : Occurrence and distribution; thallus organization and evolutionary tendencies; ultrastructure of algal cell, criteria for classification and typical life histories of algae belonging to various classes; role of algae in human welfare.

## Unit-II

- Fungi and plant diseases : Occurrence and distribution; ultrastructure of fungal cell, cell wall composition; modern concepts

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in the classification of fungi; nutrition, reproduction, life histories of main groups of fungi; types of fungal spores and mode of their liberation; role of fungi in human welfare; major diseases of plants and their control (blast and brown spot of rice; rust and smuts of wheat, downy mildew and green ear disease of bajra, white rust of crucifers, late blight of potato, wilt of pigeon pea damping off. Tikka disease of groundnut, citrus die back, powdery mildew of cucurbits, and grapes, red rot of sugarcane).

### Unit-III

19. **Bryophytes** : Comparative account of morphology, anatomy and reproduction Riccia, Marchantia, Anthoceros, Funaria, Evolution of sporophyte and gametophyte; classification, ecological aspects and economic importance.
20. **Pteridophytes** : The primary vascular plants;) classification comparative account of morphology, anatomy and reproduction in Rhynia, Lycopodium, Selaginella, Equisetum, Marsilea, Pteris; telome theory; stelar evolution; heterospory and seed habit.

### *Suggested Readings*

1. Bold, H.C., Alexopoulos., C.J. and Deltevorias, I. 1980. Morphology of Plant and Fungi (4th Edition). Harper and Foul Co., New York.
2. Clifton, A. 1958. Introduction to the Bacteria. McGraw Hill Co., New York.
3. Dube, H.C. 1990. An Introduction to Fungi, Vikas Publishing House Pvt. Ltd., Delhi.
4. Gifford, E.M. and Foster, A.S. 1989. Morphology and Evolution of Vascular Plants. W.H. Freeman & Co., New York.
5. Gilbert, M.S. 1988. Introductory Phycology. Afillated East-West Press Ltd., New York.
6. Mandahar, C.L. 1998. Introduction to Plant Viruses, Chand & Co. Ltd., Delhi.
7. Puri, P. 1985. Bryophytes, Atmaram & Sons, Delhi.
8. Rangaswamy, G. and Mahadevan, A.1999. Diseases of Crop Plants in India, Prentice Hall India Pvt. Ltd., New Delhi.
9. Sporne, K.R. 1991. The Morphology of Gymnosperms. B.I. Publications Pvt. Ltd., Mumbai, Kolkata, Delhi.
11. Wilson, N.S. and Rohwell, G.W. 1993. Palaeobotany and the Evolution of Plants (2nd Edition) Cambridge University Press, UK.

**Suggested Laboratory Exercises**

1. Comparative study of algal genera with reference to the classes, mentioned in theory.
2. Comparative study of fungal genera with reference to the classes mentioned in theory.
3. Fungal diseases : White rust of crucifers, downy mildew of pearl millet, green ear disease of bajra, powdery mildew, rust of wheat and sorghum, Tikka leaf spot disease of groundnut. Red rot of sugarcane.
4. Section cutting of fungal diseased specimens and preparation of lactophenol mounts.
5. Comparative study of morphology, anatomy and reproductive structures of representative pteridophytes available and mentioned in theory.

**Paper VI. Biology of Seed Plants**

**Unit-I**

**Phanerogams, the seed bearing plants :** General characteristics and types.

**Gymnosperms :** General characters, ontogeny and structure of ovule; the ovule and megasporogenesis, female gametophyte; pollination, formation of pollen tubes and fertilization; embryogeny and maturation of seed.

**The living cycads :** Distribution: vegetative organography and anatomy; reproductive cycle, sporophytes and sporangia gametophytes, fertilization, embryogeny and seed development.

**The coniferales :** General organography and anatomy; foliage leaves. Strobilli and sporangia: reproductive cycle, sporogenesis, gametophytes, pollination, fertilization and embryogeny.

**Unit-II**

**The Gnetales :** Habit and distribution : vegetative organography and anatomy; reproductive cycle—the strobilli, sporogenesis, male and female gametophytes, pollination, fertilization and embryogeny.

**Angiosperms :** Organography and anatomy, leaf morphology, histology and venation : vegetative to reproductive development.

**Alternatives for reproduction :** Vegetative and sexual reproduction; transition from vegetative to reproductive development.

**Flower :** Evolution; concept of flower as a modified determinate shoot, genetic control of floral organs, functions of flower.

## Unit-III

**Structure of anther :** Microsporogenesis: formation of pollen grains (male gametophyte) pollen germination. pollen tube growth.

**Structure of pistil :** Ovules : megasporogenesis, development of embryo sac (female gametophyte).

**Mechanisms and agencies of pollination :** Pollen-stigma interaction : self-incompatibility; double fertilization; apomixis.

**Seed and fruit :** Development of endosperm and embryo in monocotyledons and dicotyledons: storage of reserve materials and desiccation in seeds; dormancy and seed germination: fruit maturation: ripening and dispersal.

**Suggested Readings**

1. Cronquist, A. 1968. The Evolution and Classification of Flowering Plants, Thomas Nelson (Printers) Ltd., London & Edinburgh.
2. Delevoryas, Th. 1965. Plant Diversification, Modern Biology Series, Holt Rinehart & Winston, New York.
3. Foster, A.S. and Gifford, A.E.M., Jr. 1967. Comparative Morphology of Vascular Plants, Vakils, Pefer & Simons Pvt. Ltd.
4. Sporne, K.R. 1977. The Morphology of Angiosperms. B.I. Publication, Mumbai.
5. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas Publishing House, Delhi.
6. Johri, B.M. 1984. Embryology of Angiosperms, Springer-Verlag, Berlin.
7. Raghava, V. 1997. Molecular Embryology of Flowering Plants, Cambridge University Press, N.Y.

**Suggested Laboratory Exercises**

1. Comparative anatomical structure of stem/wood of Cycadales, Coniferales, Ginkgoales, Ephedrales. Gnetales and angiosperms, from sections and macerations.
2. Comparative structure of leaf, leaf appendages, venation and stomata of gymnosperms and angiosperms.

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3. Comparative structure of the male and female cones of Cycads, Conifers. Ginkgoales (wherever available) and Ephedrales and flowers of Ranales and Magnoliales.
4. Diversity in pollen grain structure among Cycads, Conifers, ephedrales and angiosperms with respect to size, exine sculpturing, germ pore number, number of constituent cells and any other feature.
5. Microsporogenesis and male gametophyte development in angiosperm through microtome sectioning and acetocarmine squash technique.
6. Pollen grain germination by hanging-drop and sitting-drop techniques in *Impatiens*, *Catharanthus roseus* (= *Vinca rosea*) or any other suitable material.
7. Diversity in the stigmatic papillae and transmitting tissue of style.
8. Comparison of mating types in species exhibiting heteromorphic self incompatibility *Hamelia patens*, *Pentas* or any other suitable material.
9. Studies on gametophytic and sporophytic self-incompatibility in *Petunia*.
10. Microdissection of embryo with suspensor at different stages of development to unravel relationship between the two.
11. Microdissection of endosperm with different types of haustoria.

**Paper VII. Microbiology and Plant Pathology**

**Microbiology**

**Unit-I**

1. **Discovery of Micro-organisms** : Systematic position of micro-organisms in biological world; classification of micro-organisms and characteristic features of different groups.
2. **Methods in Microbiology** : Basic principles of microscopy, micrometry, staining, sterilization methods; culture media; pure culture methods; methods for population estimation, growth determination.

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3. **Ultrastructure of Micro-organisms** : Prokaryotic micro-organisms; fine structure of prokaryotic cell; eukaryotic micro-organisms; viruses—properties and classification; characteristic features of host-virus interaction; bacteriophage T4; tobacco mosaic virus, general account of mycoplasma and actinomycetes.
4. **Genetic recombination in prokaryotes** : Conjugation, transformation and transduction.
5. **Role of micro-organisms in biogeochemical cycling of nitrogen and carbon; biological N<sub>2</sub> fixation.**

#### Unit-II

6. **Industrial application of micro-organisms** : Organic acids, alcohol, food processing, milk products, antibiotics, biopesticides.

#### Plant Pathology

7. **General account of plant pathogens** : Historical developments; general account of diseases caused by plant pathogens.
8. **Pathogen attack and defence mechanisms** : Physical, physiological, bio-chemical and molecular aspects.
9. **Plant disease epidemiology** : Transmission and spread of plant pathogens; disease cycles, epidemics: modelling and disease forecasting.
10. **Plant disease management** : Chemical, biological; IPM systems; development of transgenics; biopesticides; plant disease clinics.

#### Unit-III

11. **Genetics of resistance and susceptibility** : Genes for virulence and avirulence, their application in resistance and susceptibility; induced resistance (immunization).
12. **Molecular plant pathology** : Molecular diagnosis, identification of genes and specific molecules in disease development; molecular manipulation of resistance.
13. **Application of information technology in plant pathology** : Simulation of epidemics; programmes for diagnosis; remote sensing and image analysis for ecosystem level effects; prediction of disease control decisions.

**Suggested Readings**

**Books**

1. Agrios, G.N. 1997. Plant Pathology, Academic Press, London.
2. Albajes, R.; Gullino, M.L.; van Lentem, J.C. and Elad, Y. 2000. Integrated Pest and Disease Management in Greenhouse Crops. Kluwer Academic Publishers.
3. Bridge, P. *et al.* 1998. Molecular Variability of Fungal Pathogens. CAB International, UK.
4. Bridge, P. *et al.* 1999. Application of PCR in Mycology, CAB International, UK.
5. Bridge, P.; Moore, D.R. and Scott, P.R. 1998. Information Technology, Plant Pathology and Biodiversity, CAB International UK.
6. Persley, G.J. 1996. Biotechnologic and Integrated Pest Management, CAB International, UK.
7. Skerit, J.H. and Apples, R. 1995. New Diagnostics in Crop Sciences, CAB International, UK.

**Suggested Laboratory Exercises (Microbiology)**

1. Calibration of microscope; determination of dimensions of micro-organisms (suggested model organisms; yeast, lactobacilli, cyanobacteria).
2. Cultivation media for autotrophic and heterotrophic micro-organisms (cleaning of glasswares, mineral media, complex media, solid media, sterilization) (based on topic 3).
3. Isolation of micro-organisms; streaking on agar plates/pour plate method, isolation of clones, preservation (based on topics 2 and 3).
4. Preparation of Winogradsky column using pond bottom mud, observations on temporal sequence of appearance of microbes. (Visual appearance, microscopic observations) (based on topic 7).
5. Observation of virus infected plants (symptoms) (based on topic 5).

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6. Fermentation by yeast (inverted tube method, use of different substrates, e.g. glucose, fructose, cane sugar, starch) (based on topic 8).

*Suggested Readings (for laboratory exercises)*

1. Fulkui, K. and Nakayama, S. 1996. Plant Chromosomes : Laboratory Methods. CRC Press, Boca Raton, Florida.
2. Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes : Analysis, Manipulation and Engineering, Harwood Academic Publishers, Australia.
3. Eklund, C. and Lankford, C.W.E. 1967. Laboratory Manual for General Microbiology, Prentice-Hall, Inc., Englewood Cliffs, N.J.
4. Gunasekaran, P. 1995. Laboratory Manual in Microbiology, New Age Internatinoal Pvt.Ltd.
5. Pawsey, R.K. 1974. Techniques with Bacteria—A Guidebook for Teachers. Hutchinson Educational.
6. Pelezor, M.J. and Chan, E.C.S. 1972. Laboratory Exercises in Microbiology. McGraw Hill Book Co.
7. Meynell, E. and Meynell, G.G. 1970. Theory and Practice in Experimental Bacteriology. University Press, Cambridge.
8. Wistriech, G.A. and Lechtman, M.D. 1973. Laboratory Exercises in Microbiology, Glencoose Press, New York, Beverly Hills, Collier Macmillan Publishers, London.

*Suggested Laboratory Exercises (Plant Pathology)*

1. Study of important plant pathogens (symptoms and host parasite relationship) as per syllabus.
2. Isolation and culture of plant pathogens (e.g.; Colletotrichum, Fusarium Alternaria) and establishment of Koch's Postulates and their pathogenicity.
3. Effect of pathogens on physiology of a host.
4. Isolation of cellulose from diseased plants.
5. Isolation of pectolytic enzymes from diseased plants.
6. Study on antagonism between isolated antagonists and plant pathogens and test of biological control. Demostration of antfbiosis using a bacterial culture and known antibiotics.

7. Demonstration of the assay of prohibitions (Phytoalexins).
8. Demonstration of biopesticides (essential oils—neem, turmeric and garlic) against some pathogens.

*Suggested Readings (for laboratory exercises)*

**Books**

1. Aneja, K.R. 1993. Experiments in Microbiology, Plant Pathology and Tissue Culture. Wishwa Publication, New Delhi.
2. Mahadevan, A. and Sridhar, R. 1986. Methods in Physiological Plant Pathology. Sivakami Publications, Chennai.
3. Schaad, N.W. 1988. Plant Pathogenic Bacteria : Laboratory Guide for Identification of Plant Pathogenic Bacteria.

**Journals/Series**

Methods in Microbiology.

Methods in Enzymology.

Methods in Biochemistry.

**Paper-VIII : Genetics and Plant Breeding**

**Genetics**

**Unit-I**

**Mendel's experiments and principles of inheritance :** Backcross and test cross; gene interactions and modified dihybrid ratios-complementary, supplementary, duplicate and epistatic factors.

**Multiple allelism :** Multiple alleles in *Drosophila* (eye colour), man (blood groups and plants (self incompatibility).

**Quantitative genetics :** Quantitative traits and quantitative genetics; multiple factor hypothesis; descriptive statistics.

**Linkage and recombination :** Coupling and repulsion phases; two and three point test crosses with their significance in chromosome mapping; interference and co-efficient of coincidence.

**Sex chromosomes in *Drosophila*, Man and Melandrium :** Balance concept of sex determination in *Drosophila*; mechanisms of sex determination; sex linked inheritance in *Drosophila* and man; sex limited characters.

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**Unit-II**

**Maternal influence on heritance :** Shell coiling in snails and Kappa particles in Paramecium; cytoplasmic inheritance in yeast (mitochondria) and *Mirabilis jalapa* (plastids).

**Alterations in the genetic make-up changes at genetic level :** Spontaneous and induced mutations; mutagens—types and mode of action; transitions, transversions and frame-shift mutations; detection of mutations.

**Alterations in the genetic make-up changes in chromosome structure :** Origin, types and effects of duplications, deletions, inversions and translocations; meiosis in structural heterozygotes.

Origin, types and effects of auto and allopolyploidy; origin and meiosis in nullisomics, monosomics and trisomics.

**Unit-III****Plant Breeding**

**Types of plant reproduction :** Vegetative, sexual and apomixis; their effect on generating and fixing genotypic variation.

**Methods of plant improvement :** Pure line and mass selection; hybridization in self and cross pollinated crops; introduction and acclimatization; hybrid vigour.

**Mutations and polyploidy as methods of plant improvement.**

***Suggested Readings***

1. Atherly A.G., Girton, J.R. and McDonald, 1999. *The Science of Genetic*. Saunders College Publishing Co. Fortworth, USA.
2. Gardener, J.; Simmons, H.J. and Snusted, D.P. 1991. *Principles of Genetics* (8th Edition). John Wiley & Sons, New York.
3. Gupta, P.K. 1994. *Genetics*. Rastogi Publications, Meerut.
4. Gupta, P.K. 1995. *Cytogenetics*, Rastogi Publications, Meerut.
5. Harti, D.L. and Jones, E.W. 1998. *Genetics : Principles and Analysis* (4th Edition). Jones & Bartlett Publishers, Massachusetts, USA.

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6. Poehlmann, J.M. and Sleeper, D.R. 1995. Breeding Field Crops. Panima Publishing House, New Delhi.

*Suggested Laboratory Exercises*

1. Determination of chromosome count from dividing pollen mother cells, root tips and pollen grains.
2. Preparation of karyotypes from dividing root tip cells and pollen grains.
3. Determination of intraspecific variation in chromosome number from locally available taxa.
4. Study of sex chromosomes and their behaviour during meiosis from grasshopper and any appropriate dioecious plant (e.g., Coccinia).
5. Detection of anomalies in chromosome pairing and disjunction caused by mutant genes and structural alterations of chromosomes.
6. Preparation of chromosome maps from 3-point test cross data.
7. Identification of mutant phenotypes in Drosophila and Arabidopsis stocks maintained by the Department.
8. Correlation of floral structure with pollination system (e.g., Salvia, Sesamum, pea, lathyrus, wheat, rice, maize, ricinus).
9. Field exploration for detection of male sterile plants and estimation of their pollen fertility in locally grown crop plants e.g., sorghum, tomato and linum.
10. Estimation of pollen ovule ratio and its bearing on pollination system.
11. Emasculation and bagging of flowers of Brassicaceae, Poaceae, Papilionaceae, Malvaceae and Linaceae, pollinating them manually and estimating fruit and seed set.

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## 5. MATHEMATICS

Teaching : 3 hours per week per Theory paper.

2 Hours per week per Batch for Practical

(20 candidates in each batch)

Examination :

Min. Pass Marks-160

Max. Marks-400

Scheme :

		Duration	Max. Marks	Min. Pass Marks
Paper-V	Real Analysis and Metric Space	3 hrs.	100	40
Paper-VI	Differential Equations	3 hrs.	100	40
Paper-VII	Numerical Analysis	Theory : 2 $\frac{1}{2}$ hrs.	68	27
	Vector Calculus	Practical : 2 hrs.	32	13
Paper-VIII	Operation Research	3 hrs.	100	40

Note :

1. Papers V, VI and VIII will be 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.
2. Paper VII is divided into FOUR Units. TWO questions will be set from each Unit. Candidates are required to attempt FOUR questions in all taking ONE question from each Unit. All questions carry equal marks.
3. 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.
4. 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

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Principal in consultation with Local headwead, Department of Mathematics in the college.

5. An Internal/external examiner can conduct Practical Examination not more than 100 (Hundred) candidates (20 Candidates in one batch).
6. Each candidate has to pass in Theory and Practical examination separately.

**Paper-V : Real Analysis and Metric Space**

**Teaching : 3 Hours per Week**

**Duration of Examination : 3 Hours      Max. Marks : 100**

**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. Union and Intersection of such sets. Concept of compactness. Heine-Borel theorem. Connected sets.

Real sequences—Limit and Convergence of a sequence. Monotonic sequences.

**UNIT-2**

Cauchy's sequences. Subsequences, Cauchy's general principle of convergence. Properties of continuous functions on closed intervals. Properties of derivable functions. Darboux's and Rolle's theorem.

**UNIT-3**

Notion of limit and continuity for functions of two variables.

Riemann integration—Lower and Upper Riemann integrals, Riemann integrability, Mean value theorem of integral calculus, Fundamental theorem of integral calculus.

**UNIT-4**

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

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convergence and Continuity of series of functions, Term by term differentiation and integration.

Metric space—Definition and examples, Open and Closed sets, Interior and Closure of a set. Limit point of a set.

#### UNIT-5

Subspace of a metric space, Product space, Continuous mappings, Sequence in a metric space. Cauchy sequence, Complete metric space, Baire's theorem, Compact sets and Compact spaces, Connected metric spaces.

#### Paper-VI : Differential Equations

Teaching : 3 Hours per Week

Duration of Examination : 3 Hours      Max. Marks : 100

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  $n$ th 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

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the dependent variable/the independent variable. Factorization of operators, Method of variation of parameters, Methods 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.

#### Paper-VII : Numerical Analysis and Vector Calculus

**Teaching : 3 Hours per Week**

**Duration of Examination : 2½ Hours      Max. Marks : 68**

**Note :** (i) This paper is divided into FOUR Units. TWO questions will be set from each Unit. Candidates are required to attempt FOUR questions in all taking ONE questions 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. Interpolation formula. 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. Newton-Cote's formula. Trapezoidal rule, Simpson's one-third, Simpson's three-eighth and Gauss's quadrature formulae.

#### UNIT-3

Numerical solution of algebraic and transcendental equations. Bisection method. Regula-Falsi method. Method of iteration, Newton-Raphson method. Gauss elimination and Iterative methods (Jacobi and Gauss Seidal) for solving system of linear algebraic simultaneous equations. Solutions of ordinary differential equations of first order with initial and boundary conditions using Picard's and modified Euler's method.

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**UNIT-4**

Scalar point function. Vector point function. 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.

**PRACTICAL**

**Teaching : 2 Hours per Week per Batch**  
**(20 Candidates in each Batch)**

**Examination :**

**Scheme**

**Max. Marks** 32

**Min. Pass** 13

**Distribution of Marks :**

Two Practicals one from each group		
10 Marks each	=	20 Marks
Practical Record	=	06 Marks
Viva-voce	=	06 Marks
Total Marks	=	32 Marks

**Group A :** Numerical integration using Trapezoidal and Simpson's rules. Numerical solution of Algebraic and Transcendental equations using (i) iteration method (ii) Newton's—Raphson Method and (iii) Regula-falsi method.

**Group B :** Numerical solution of the system of linear equations by Jacobi and Gauss-Seidel methods. Solution of linear differential equations of first order and first degree with initial and boundary conditions using Picard's and modified Euler's method.

**Note :**

1. Problems will be solved by using Scientific Calculators (non-Programmable)
2. Candidates must know about all functions and operations of Scientific Calculator.
3. Each Candidate (Regular/non-Collegiate) has to prepare his/her practical record.
4. Each Candidate has to pass Practical and Theory examinations separately.

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**Paper-VIII : Operation Research**

**Teaching : 3 Hours per Week**

**Duration of Examination : 3 Hours      Max. Marks : 100**

**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**

Assignment models—Mathematical formulation. Hungarian method, Variations of the assignment problem. Travelling-salesman problem.

Transportation models—Mathematical formulation, Initial basic feasible solution. Transportation algorithm for minimization problem, Degeneracy and unbalanced transportation problems.

**UNIT-2**

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  $2 \times 2$  games. Graphical method for  $2 \times 2$  games.

**UNIT-3**

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-4**

Probability Theory—Probability distributions of a random variable, Standard deviation, Variance, Mathematical expectation, Binomial, Poisson and Normal distributions.

**UNIT-5**

Queueing Theory—Introduction, Probability distributions in queueing systems. Models-Erlang model, general Erlang model, Model III (M/M/1) : (N/FCFS).

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## 6. GEOGRAPHY (HONS.)

Scheme :

Min. Pass Marks : 160 (40%)

Max. Marks : 400

Papers	Duration	Max. Marks
Paper-V Introduction to Political Geography	3 hrs.	80
Paper-VI Geography of Rajasthan	3 hrs.	80
Paper-VII Biogeography	3 hrs.	80
Paper-VIII Statistical Methods in Geography	3 hrs.	80
Practical		80

Note :

- Students are permitted to use the stencils, simple calculator and Log Tables, where needed in the examinations.
- Q.1. in all papers will be compulsory and will cover the entire course contents of the paper.  
One question (Q.No. 1) of 20% marks of the total marks be set in two parts.  
(a) Q. on map (to be supplied) of 10% marks.  
(b) Q. objective type (Multiple choice and very short answer) of 10% marks.
- Nine questions will be set with three questions from each section.
- The candidates will attempt five questions selecting at least one from each section.
- For practical paper each student will attend a socio-economic survey camp and write a report. The report should be supported by maps and diagrams.
- The students will have to pass separately in theory and practical.
- Annual Theory examination will be of 3 hours duration.

**Paper-V : Introduction to Political Geography****Section-A**

Nature, scope and significance of Political Geography, Political Geography and Geopolitics.

Approaches to the study of Political Geography : Morphological and functional.

Role of Physical, demographic, economic and socio-cultural factors in Political Geography.

**Section-B**

State as a politico-territorial Phenomenon. The changing value of

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location, size and shape in the Political Geography of states.

Organisation of Government over the national territory-unitary and federal.

Boundaries and frontiers : function and classification of international, federal.

**Section-C**

Global Strategic Views : The views of Mackinder, Spykman, de Seversky, Mahan and the Unified Field Theory of S.B. Jones. Underdevelopment and international policies, the North-South dialogue and new international economic order.

International tensions—identification of tension areas and factors contributing to tension in different areas with special reference to West Asia and the Indian Ocean Region. Regionalism in international relations.

**Recommended Books :**

1. Dikshit, R.D. : Political Geography : A Contemporary Perspective. Tata McGraw-Hill Publishing, Co. New Delhi.
2. Bhagwati, J.N. (ed.) : New International Economic Order—The North-South Debate, M.I. T. Press, London, 1976.
3. Prescott, J.R.V. : Political Geography, Methuen & Co. London, 1972.
4. Taylor, Peter : Political Geography, Longman, London.
5. Short, J.R. : An Introduction to Political Geography. Routledge & Kegan Paul, London, 1982.

**Reference Books :**

1. Taylor, Peter : Political Geography : Recent Advances and Future Directions. Barne and Noble Books, Totwa, J.N., 1984.
2. De Blij, Harms, J. : Systematic Political Geography, John Wiley & Sons Inc. New York, Latest Edition.
3. Muir, R. : Modern Political Geography, McMillan, London, 1981.

**Paper-VI : Geography of Rajasthan**

**Section-A**

Location of Rajasthan and its position in India. Physical features and topography, geology, soil, drainage, vegetation, climate and climatic regions.

**Section-B**

Agriculture—major crops, problems of agriculture, agricultural typology, wasteland and its problems. Agro climate regions. Irrigation—Sources of irrigation, major irrigation projects—Indira Gandhi Canal and the Chambal Command Area, Industries—Location of industries, major industries, small scale industries, minerals and their utilization.

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**Section-C**

Population – Number, growth, distribution and density.

Settlement Patterns – Types of settlements, building materials and house types in Rajasthan.

Regional Geography of Rajasthan : Geographical Regions— Desert region, East Rajasthan upland, Indira Gandhi Canal Command Region. The Chambal Command Area, Haudoti Region, Mewar Region, The Aravalli Region.

**Recommended Books :**

1. Mishra, V.C. (1976) : Geography of Rajasthan. National Books Trust, New Delhi.
2. Chauhan, T.S. (1986) : Agricultural Geography of Rajasthan.
3. Dhabaria, S.S. (1988) : Desert Spread and Desertification, Environmentalist, Jaipur.
4. Dhabara S.S. (1988) : Ecocrises in the Aravalli Hill Region, Environmentalist, Jaipur.
5. Bhalla, L.R. (1989) : Rajasthan Ka Bhugol, Kuldeep Publications, Ajmer, Second Edition.
6. Sharma B.I., (1984) : Agricultural Typology of Rajasthan.

**Paper-VII : Introduction to Bio-Geography****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 levels and food chain : Darwin's theory of Evolution, concepts of Biome, Ecotone and Community.

**Section-B**

Origin of Fauna and flora : Geographical distribution, major genecentres domestication of plants and animals and their dispersal. Distribution of plant life on the earth and its relation to 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**

Problems of extinction of some major plant and animal life : Habitat decay and their conservation. Process of desertification—Its consequences and its management principles.

Industrial affluent and its effect on fresh water biology and marine biology management practice (Special reference to India). Study of two ecological regions of India in relation to their plant and animal life, their interrelations, problems, conservation and management measures.

**Recommended Books :**

1. Robinson, H : Biogeography, ELBS, McDonald and Evans. London, 1982.

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2. Simmons, I.G. : Biogeographical Processes, George Allen and Unwin, London.
3. Berry, C. : Biogeography-An Ecological and Evolutionary Approach, Cox Balckweel, Oxford, 1977.

**Reference Books :**

1. Seddon B : Biogeography, Duckworth, London, 1971.
2. Martin, C : Plant Geography, Mathuen, 1972.
3. Phillip, J. Zoo Geography : The Geographical Distribtuion of Animals. John Wiley, New York, 1957.

**Paper-VIII : Statistical Methods in Geography**

**Section-A**

Significance of the statistical techniques in geographic studies.  
Data and its problems, Analysis of data.

Frequency distributions, Characteristics of frequency distributioin :  
number of classes : class-interval.

Percentage frequencies : cummulative frequencies.

Types of frequency graphs histogram : frequency polygon :  
frequency curve.

**Section-B**

Measuress of central tendency : means, median, mode, arithmetic  
mean and geometric mean.

Measure of variations of dispersion : crude range.

Quartile deviation : quartiles for grouped and upgrouped data:  
median and the quatile; standard deviation : Normal curve : Relative  
variation; measures of Skewness : Kurtosis.

**Section-C**

Theoy of probability—Basic Principles : axioms probability :  
Probability distribution. Theory of sampling : types of sampling :  
random and systematic sampling : problems of application of sampling  
methods of geography.

**Reference Books :**

1. Aslam, Mahmood—Statistical Methods in Geographical Studies.  
Rajesh Publications, Delhi 1977.
2. Duncan, O.D. *et al.*—Statistical Geography, (Problems in  
Analysing Areal Data), Free Press of Blenco, New York, 1961.
3. Gregory, S.—Statistical Methods and the Geographer. Longmans  
London, 1963.
4. King, L.J.—Statistical Analysis in Geography. Prentice Hall,  
Englewood Clifs, NJ.
5. Lewis. Peter-Maps and Statistics, Methuen & Co. Ltd. London,  
1977.

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6. Monkhouse, F.J. and H.R. Wilkinson—Maps and Diagrams, Methuen & Co. London, 1967.
7. Norchife—Inferential Statistics for Geographers, B.I. Publications, Chennai, 1985.
8. Singh, R.L.—Elements of Practical Geography, Kalyani Publishers, New Delhi, 1979.
9. Yeates, Mauric M.—An Introduction to Quantitative Analysis in Economic Geography, McGraw-Hill New York, 1968.

#### Geography Practical

#### Scheme :

Min. Pass Marks : 32

Max. Marks : 80

Distribution of marks for purpose of examination :

	Marks	Time
1. Written Test	30	3 hrs.
2. Field of Survey and viva	15 (10+5)	2½ hrs.
3. Socio-economic survey camp report and viva	15 (10+5)	2½ hrs.
4. Record and viva	20 (12+8)	

**Course Contents :** Representation of population, Economic and Commercial data on maps and diagrams—Point symbols (dots, circles, spheres), Line and area symbols (Isopleths and choropleth. use of mean, Median, quartile and standard deviation in mapping use of line and bar graphs for representing trends in population, agricultural, industrial and transport data.

Plane table survey (intersection, traverse, resectioning, use of clinometer, meaning and interpretation of remote sensing.

Social-economic survey of a town/village within the state of Rajasthan. The report will be submitted at the time of practical examination. The expenditure on the T.A./D.A of the teachers and 50 per cent of the transport charges on the students shall be met out from the University/College fund.

#### Reference Books :

1. Monk House, F.J. : Maps and Diagrams, Methuen & Co., London, Latest Edition.
2. Robinson, A.H. and others : Elements of Cartography, John Wiley and Sons, New York. Latest Edition.
3. Singh, R.L. and Dutt, P.K. : Elements of Practical Geography, Students Friends, Allahabad.
4. Mishra, R.P. Ramesh A. : Fundamentals of Cartography, Macmillan, New Delhi, 1986.
5. Mahmood, Aslam : Statistical Techniques in Geographical Studies, Rajesh Publishers, New Delhi.

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14. PSYCHOLOGY (HONS.) Pt II

**Scheme :**

<b>Four Theory Papers</b>	<b>Duration</b>	<b>Max. Marks</b>	<b>Min. Pass Marks</b>
Paper-V	3 hrs.	75	
Paper-VI	3 hrs.	75	120
Paper-VII	3 hrs.	75	
Paper-VIII	3 hrs.	75	
Practicals		100	40

Note: : There will be 4 theory papers in subject Psychology in BA Hons Part II. There will be common paper for Arts and Science Questions No. 1 will be compulsory and will cover the entire course contents of the paper. Questions I will contain two parts A & B. A part of I question will contain 20 questions of multiple choice. Each question will be of 3/4 mark. Thus A part will be of 15 marks. B part will contain 10 questions to be answered in the limit of 20 words. Each question of B part will be of 1½ marks. Thus B part will be of 15 marks. Separate question paper for this objective type will be provided to each student and answers will be given in this question paper only in the space provided for this purpose in the objective type question paper. Candidates will be given one hour to attempt this first compulsory question out of three hours in total time allotted for this paper.

In the second part of the question paper, three questions of essay type will be attempted selecting at least one from each section. Each question will be of 15 marks. This objective type question will be compulsory to attempt in all four theory papers.

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**B.A./ B.Sc. Honours Part-II**

**Paper-IV Systems of Psychology**

**Section-A**

1. Psychology as a Science: Origin, Present Status, Introduction to Schools of Psychology.
2. Beginnings of Scientific Psychology: Wundt, Webar, Fechner, Helmholtz.
3. Structuralism

**Section-B**

4. Functionalism
5. Behaviourism
6. Gestalt Psychology

**Section-C**

7. Freudian Psychoanalysis
8. Neo-Freudians: Horney, Fromm and Sullivan
9. Dynamic Psychology: Woodworth and McDougal

**Reference Books:**

1. Hergenhahr, B.R. (2001) An Introduction to the history (4<sup>th</sup> edition), New Delhi: Cengage Learning
2. Leahey T.H. (2006) History of Psychology: Main currents in psychological thoughts, New Delhi: Pearson Education.
3. Shultz D.P. (2003). History of psychology (4<sup>th</sup> Edition), New Delhi: Pearson Education
4. Singh, A.K. (1997), The Comprehensive history of psychology. New Delhi: Motilal Banarsi Das.

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**Paper II: Social Psychology**

**Section-A**

1. **Introduction:** History of Social Psychology, Subject Matter of Social Psychology, Social Psychology as an Applied Science, Importance of Social Psychology.
2. **Social Cognition:** Schemas, Mental Frame Work for organizing Social Information, Heuristics and Automatic Processing, Potential Sources of Errors in Social Cognition, Affect and Cognition.
3. **Social Motivation and Attraction:** Meaning, Types of Social Motivation, Theory of Achievement Motivation, Inter-personal Attraction - Its meaning, determinants and Theories.

**Section-B**

4. **Social Attitude:** Development of Attitudes, Functions of Attitude, Attitude Change, Measurement of Attitude.
5. **Groups and Organisations:** Basic characteristics of group structure, Norms and ideology, Performance in group and individual situation, Cooperation and Conflict, Decision making in groups.
6. **Leadership:** Attributes of leadership, Origin of leadership, Functions, Type and Theories of leadership.

**Section-C**

7. **Prejudice and Stereotypes:** Meaning, Nature and Origin of prejudice, stereotypes – beliefs about social groups, reasons of forming and using Stereotypes, Techniques for countering Prejudice and Stereotypes.

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8. **Public Opinion and Propaganda: Meaning, Formation and measurement of Public Opinion, Propaganda – its Meaning, Nature and Principles, Effect of media on propaganda, propaganda as an Effective tool.**
9. **Social Tension and Social Change: Meaning, types and causes of social tensions, effect of social tensions, methods of reducing social tensions. Social change: Meaning, Characteristics and Agents of social change, Resistance to social change, Effects of social changes.**

**Reference Books:**

1. Baron, R.A. and Byrne, D. (2010). Social psychology (11<sup>th</sup> edition), New Delhi: Person education.
2. Mohammad, S. (2009). Ucchar samaj manovigyan. New Delhi: Motilal Banarsi Das.
3. Myers, D. (2007). Social psychology. New Delhi: Cengage learning.
4. Singh, A.K. (2009). Samaj Manovigyan ke ruprekha. New Delhi: Motilal Banarsi Das.
5. Taylor, S.E. David, L.A. and Sears, O. (2009). Social psychology (12<sup>th</sup> Edition). New Delhi: Pearson education.

**Paper-VII: Counselling Psychology**

**Section-A**

1. **Counselling: The Art and Scheme of Helping**
  - (a) Meaning, purpose and goals of counselling with special reference to India
  - (b) Professional issues, ethics, education and training of the counsellor.

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2. **Counselling Process**
  - (a) Counselling relationship
  - (b) Counselling interviews

**Section-B**

3. **Theories and Techniques of Counselling**
  - (a) Psychodynamic Approach: Freudian, Neo-Freudian, Modern.
  - (b) Humanistic Approach: Existential, client centered.
4. **Theories and Techniques of Counselling**
  - (a) Cognitive Approach: Rational emotive, Transactional analysis.
  - (b) Behavioural Approach: Operant conditioning, Behaviour modification.
  - (c) Indian Contribution: Yoga and Meditation.

**Section-C**

5. **Counselling Applications**  
Child Counselling, Family Counselling: Counselling in Schools. Career Counselling,
6. Alcohol and Drug Abuse, Group Counselling, Crisis Intervention Counselling.

**Reference Books:**

1. George, R.L. and Cristiani, T.S. (1994) Counselling Theory and Practice (IV Ed.) New Delhi: Prentice - Hall.
2. Gibson, R.L. and Mitchell, M.H. (2005). Introduction to Counselling and Guidance. New Delhi: Pearson education.
3. Gelso, C.G. and Fretz, B. (2003) Counselling Psychology; Practices, Issues and Interventions New Delhi: Cengage learning.

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4. Capuzzi's (2008). Counselling and Psychotherapy (4<sup>th</sup> Ed.). New Delhi: Pearson education.
5. Gladding, S. (2009). Counselling; A comprehensive profession. New Delhi: Pearson education.

VIII Paper-~~B~~: Biological Basis of Behaviour

Section-A

1. **Introduction:** Definition, Scope and methods of studying Biological basis of behaviour.
2. **Structure and Functions of Cells of Nervous system:** Neurons, communication within a neuron, communication between neurons.
3. **Structure and Functions of Nervous system:** Basic feature, CNS and PNS: Functions, Neurotransmitters.

Section-B

4. **Lateralization of Brain functions:** Difference between left and right hemispheres, cortical localization of language, Aphasia.
5. **Ingestive behaviour:** Physiological Regulatory mechanism, Eating, Brain mechanism in Eating disorders.
6. **Sleep and Waking:** Physiological mechanism of sleep and waking; Biological clock and sleep disorders.

Section-C

7. **Learning and Memory:** Nature of Learning, Neural mechanism of learning and memory, Disorders of Memory.

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8. **Emotion, Stress and Health: Fear, Anger, Aggression; Stress and Health; Hormones and Emotion.**
9. **Fundamental Genetics – Mendelian Genetics, Chromosomes – Structure, Cell Division:- Mitosis and Meiosis, Nature and Nurture controversy (Heredity / Environment), Inheritance of Intelligence, Mental Retardation and Psychopathology in Humans.**

**Reference Books:**

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

**Practicals:**

1. Sociometry
2. Attitude Scale
3. Value Test
4. Level of Aspiration
5. Assessment of Leadership Qualities
6. Hand withdrawal or knee-jerk conditioning
7. Pneumograph (Respiration Curve)
8. Biofeedback
9. Two Point Threshold
10. Reaction Time
11. Saving method
12. Sentence Completion Test

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