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Dy. Registrar (Acad.)
University of Rajasthan
JAIPUR
SCHEME OF EXAMINATION
B.Sc. (Honours) Part-II
(10+2+3 Pattern)

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

Successful candidates will be classified as under:

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

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

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

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

**Honours Subjects**:

1. Physics
2. Chemistry
3. Zoology
4. Botany
5. Mathematics
6. Geography
7. Psychology
B.Sc. (Hons.) Part-II Examination
(Three Years Scheme)

N.B. : Candidates shall be required to offer Four papers and Practical (wherever prescribed) of the Honours subject offered by him.

**DISTRIBUTION OF MARKS**

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University of Rajasthan
Jaipur
1. PHYSICS

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

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.


Unit-II Fraunhofer Diffraction

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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.


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


Optical activity, Specific rotation. Biquartz and half shade polarimeters.
Syllabus: B.Sc. (Hons.) Pt.-II

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. Yashidelwal
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.


Unit-II

Unit-III

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:
University of Rajasthan

(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 3x3 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.)
Syllabus: B.Sc. (Hons.) Pt.-II

Paper-VII : Quantum Mechanics

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

Unit-I

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

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

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

Unit-II

Unit-III


Unit-IV


Three Dimensional Square Well Potential: Solution in the Interior Region. Solution in the Exterior Region, and Matching:
Syllabus: B.Sc. (Hons.) Pt.-II

(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 Schroedinger 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:

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.
Teaching: 4hrs/week Max. Marks 75

Unit-I

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

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

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

Unit-II


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

Unit-IV

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

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

Unit-V

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


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 Valcumurg: Network Analysis
6. J.D. Ryder: Network Analysis

Physics Practical

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

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

2. Determine the theromdynamic constant $\gamma$ (gamma) = $C_p/C_v$
using elements and Desormes method.

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

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

5. Study of variation of total thermal radiation with 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.


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

15. To determine $\eta$ by Thomson’s method.
2. **CHEMISTRY**

**Scheme:**
**Max Marks: 400**

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*(Complete in TWO days)*

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

**Paper-V Inorganic Chemistry**
*(4 hrs / Week)*

**UNIT-I**

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

**Magnetic properties of transition metal complexes:**
Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of $\mu_s$ and $\mu_{\text{eff}}$ values, orbital contribution of magnetic moments, application of magnetic moment data for 3d-metal complexes.

**UNIT-II**

**Theories of Coordination Compounds:**
Valence bond theory of transition metal complexes, limitations of valence bond theory.
Crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters, Jahn-Teller effect.
Application of crystal field stabilization energy in explaining ionic radii of divalent ions of first transition series, heat of hydration of divalent ions of first transition series.

**UNIT-III**

**Electronic spectra of Transition metal complexes:**
Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, $\text{Or}g_{\text{el-energy level diagrams for } d^1 \text{ and } d^9 \text{ states. Discussion of the \text{electron spectrum of } [\text{Ti} \left(H_2O \right)_6]} \text{ complex ion.}}$

**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 of lanthanide compounds.

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

UNIT-V

Oxidation and Reduction:
Redox potential data and their analysis, redox stability in water, Frost, Latimer and Pourbaix diagrams, Application of redox data in the extraction of the elements.

Acids and bases:

Non-aqueous Solvents:
Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH₃ and liquid SO₂.

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

Unit-I

Alcohols
Classification and nomenclature.
Dihydric alcohols: Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)₄ and HIO₄⁻] and pinacol-pinacolone rearrangement.
Trihydric alcohols: Nomenclature, methods of formation and chemical reactions of glycerol.

Phenols

Ethers and Epoxides
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 and Knoevenagel condensation. Perkin, Wittig, Mannich and Cannizzaro's reactions.
Use of acetics as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones.
MPV (Meerwein Poonrod Verley) reduction, Clemmensen, Wolff-Kishner. LiAlH4 and NaBH4 reductions. Halogenation of enolizable ketones.
An introduction to α,β-unsaturated aldehydes and ketones. Preparation and properties of acrolein, crotonaldehyde and vinyl methyl ketone, Michael reaction.

UNIT-III

Carboxylic Acids
Aromatic carboxylic acids: Synthesis and reactions of benzoic acid, salicylic acid, phthalic acid and cinnamic acid.
Methods of preparation and chemical reaction of α, β and γ-hydroxy acids. malic, tartaric and citric acids.

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

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

UNIT-IV

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

Aryl diazonium salts: Preparation and synthetic transformations, azo coupling. Diazomethane and its applications.
UNIT-V

NM : Spectroscopy
Proton magnetic resonance spectroscopy : Introduction, nuclear spin and energy levels, transitions, equivalent and non-equivalent protons, nuclear shielding and deshielding, chemical shift, spin-spin coupling and coupling constant, areas of signals. Interpretation of PMR spectra of simple organic molecules like C$_2$H$_5$Br, C$_2$H$_5$OH, CH$_3$CHO, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.
Note: Mechanism of the reactions should be studied wherever possible.

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

Unit - I

Electrochemistry:
(a) Electrolytic conduction, specific, equivalent and molar conductivities and their determination. Variation of conductance with dilution. Effect of temperature, pressure, solvent and viscosity on conductance.
Kohrausch’s law and its applications in determination of
   (1) Degree of dissociation and dissociation constant of weak acids
   (2) Solubility of sparingly soluble salts
   (3) Hydrolysis constant
   (4) Ionic product of water
   Inter-ionic attraction theory, quantitative treatment of theory of strong electrolytes, verification of the Debye-Huckel Onsager equation, activity and activity coefficient, ionic strength.
(b) Transference number and their determination by
   (1) Hittrof’s method
   (2) Moving boundary method.
   Abnormal transference numbers.

Unit – II

Thermodynamics:

Unit – III

Spectroscopy:
Electromagnetic radiations and wave parameters interaction of electromagnetic radiations with matter. 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-

**Unit – IV**

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

**Unit – V**

**Photochemistry:**
Absorption of light, Grothus – Dropper law. Einstein law of photochemical equivalence. Quantum yield of photochemical reactions, reasons for high and low quantum yield of photochemical equations. Primary and secondary processes, photochemical reactions such as (1) $\text{H}_2 + \text{Cl}_2$ reaction (2) photolysis of ammonia (3) hydrolysis of monochloro acetic acid. Consequences of light absorption phosphorescence, fluorescence, chemiluminescence and photosensitization.

**Nuclear Chemistry:**

Nuclear Models: Liquid drop model, magic number and shell model.
Nuclear Fission: nuclear reactor and atom bomb
Nuclear Fusion: Hydrogen bomb
Applications of radioactivity in chemistry

Tracer techniques:
(1) Radiocarbon dating
(2) Reaction mechanism
(3) Biology and medicine

**Suggested Books:**
1. Physical Chemistry by S. Glasston.
2. Elements of Physical Chemistry by Lewis and Glasston.
3. Physical Chemistry by Atkins.
4. Thermodynamics by Mishra & Rastogi.
5. Physical Chemistry by Moore.

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

UNIT-I

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

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

UNIT-II

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

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

UNIT-III

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

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

UNIT-IV

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

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

UNIT-V

B.Sc. (Hons.) Pt.-II CHEMISTRY PRACTICALS
(8 hrs. or 12 periods/week) (Spread over Four days)

Inorganic Chemistry
Quantitative (Gravimetric) (any three)
   a) Estimation of Barium (as sulphate)
   b) Lead (as chromate)
   c) Copper (as Cuprous thiocyanate)
   d) Nickel (as dimethyl glyoximate)
   e) Silver (as chloride)
   f) Zinc (as Zinc ammonium phosphate)
   g) Magnesium (as Magnesium hydrogen phosphate, MgHPO₄)

Inorganic Preparations (any four) of coordination compounds and their characterization:
   a) Chloropenamminecobalt(III) chloride.
   b) Cuperous chloride, Cu₂Cl₂.
   c) Tetramminecopper(II) sulphate.
   d) Pyridine complex of copper
   e) Prussian blue.
   f) Hexamammenenickel(II) chloride.

Organic Chemistry
   (i) Identification of simple organic compound and preparation of its suitable derivative.
   (ii) Simple one step organic preparation--the students are expected to perform at least five of the
   following preparations:
      (a) Preparation of m-dinitrobenzene from nitrobenzene.
      (b) Preparation of acetalilide from aniline.
      (c) Preparation of aspirin from salicylic acid.
      (d) Preparation of o- and p-bromo acetalilide from acetalilide.
      (e) Preparation of o- and p-bromo aniline from o- and p-bromoacetalilide.
      (f) Partial reduction, m-dinitrobenzene into m-nitro aniline.
      (g) Preparation of methyl orange from sulphanilic acid.
      (h) Preparation of acetylglucine from glycine.

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

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

Transition temperature:
   a) Determination of transition temperature by thermometric method.

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

Conductometry:

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

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

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

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

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

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

100

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3. **Zoology**

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

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

**Paper-VII: Animal Diversity –3**

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

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

**Section - A**

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

**Section - B**

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

**Section – C**


**Section – D**

7. Reptiles – Classification up to orders, extinct reptiles, skull types in reptilians, biting apparatus and biting mechanism of any poisonous snake, poisonous & nonpoisonous snakes of India.
Paper-VIII: Animal Diversity-4

Scheme of Examination: 

Max. Marks: 50

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

Section – A

1. Origin of birds, Bird migration and principles of bird flight, types of feathers, flight adaptations, perching mechanism.
3. Poultry keeping.

Section - B


Section – C

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

Section - D

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

Paper-IX: Physiology –I

Scheme of Examination: 

Max. Marks: 50

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

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

Section - B

4. Blood: Composition and function of blood and lymph, blood groups, blood coagulation, structure and function of hemoglobin.
5. Heart: Structure, origin, conduction and regulation of heart beat, cardiac cycle and ECG.

Section - C

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

Section - D

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

Paper-X: Physiology - 2

Scheme of Examination: Max. Marks: 50

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

Section - A

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

Section - B

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

Section - C

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

Section - D

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

Paper - XI: Immunology

Scheme of Examination: Max. Marks: 50

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

Section - A

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

Section - B

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

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Section - C

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

Section - D

8. MHC: Structure and function of class I, II and III MHC molecules. Genomic map of MHC genes. Regulation of MHC expression.
9. Immunotolerance.
10. Autoimmunity: Involvement of CD4+ cells, contributing factors in autoimmune disease. Autoimmune disease: Hashimoto's thyroiditis. Type I diabetes, Myasthenia Gravis, Rheumatoid arthritis, autoimmune hemolytic disease.

Paper -XII: Ethology

Scheme of Examination: Max. Marks: 50

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

Section - A

1. Introduction: Ethology as a branch of biology and its significance.

Section - B

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

Section - C

10. Biological rhythms: Circadian rhythms and migration of fishes & birds.
Section - D

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

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

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

Practicals

1. Anatomy: Study of the following with charts / models / CD etc.
   Any edible fish: Afferent & efferent branchial arteries, cranial nerves, eye muscles and internal ear.

2. Museum specimens:

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

4. Study of permanent microscopic slides:
   Dololimn, Salpa, Oikopleura, Amphioxus; whole mount and T.S. passing through different regions of the body. Ammocoete larva: T.S. passing through different regions of the body. Scoliodon: T.S. passing through different regions of the body, Mammalian histology: T.S. of Liver, lung, testes, ovary, pancreas, thyroid, parathyroid, adrenal, stomach, duodenum, intestine, bone & cartilage, L.S. / T.S. of pituitary.

5. Permanent preparation

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

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

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

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

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

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

Scheme of practical examination and distribution of marks

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

Min marks: 20 Max marks: 50

1st day Regular

1. Anatomy 5
2. Permanent preparation/ microtomy 6
3. Exercise in Immunology 8
4. Identification and Comments on spots (1 to 5) 16
5. Viva voce 5
6. Class Record 5
7. Seminar/Project Report/Collection 5

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II\textsuperscript{nd} day

1. Exercise in Physiology
   (a) Major  
   (b) Minor  
   \hspace{\stretch{1}} 10  
   \hspace{\stretch{1}} 5  
2. Exercise in Ethology  
   \hspace{\stretch{1}} 5  
3. Identification and Comments on spots (1 to 5)  
   \hspace{\stretch{1}} 15  
4. Viva voce  
   \hspace{\stretch{1}} 5  
5. Class record  
   \hspace{\stretch{1}} 5  
6. Seminar/Project Report/Collection  
   \hspace{\stretch{1}} 5  

Note:

2. With reference to anatomy, the candidate must be well versed with the techniques of flag labeling and black paper insertion as the case may be for a clear illustration. Study of the various systems may be carried with the help of charts/models/CD-ROM's/high resolution picture/video's of lives anatomy and web-site dedicated to alternative of animal anatomy providing free wares.

3. With reference to whole mounts and museum specimens in case of unavailability, the animal types should be substituted with diagrams/photographs/models etc.

4. Students will keep records of all work done in the practical records.

5. It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.

6. The details methodology may be asked to be written where ever is necessary.

Recommended books:

4. **BOTANY**

B.Sc. Part-II

Maximum Marks: 400  
Min. Pass Marks: 160

**Paper-V**  Molecular Biology  
75 Marks

**Paper-VI**  Pteridophyta, Gymnosperm & Paleobotany  
75 Marks

**Paper-VII**  Morphology and Anatomy of Angiosperms  
75 Marks

**Paper-VIII**  Microbiology and Plant Pathology  
75 Marks

**Practical (6 Hrs.)**  
100 Marks
UNIT-I

Structure of Nucleic Acid
Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix. Types of DNA. Types of genetic material, denaturation and renaturation, cot curves. Organelle DNA -- mitochondria and chloroplast DNA. Structure of RNA. types of RNA (tRNA, mRNA, Ribosomes, miRNA, siRNA) and their functions.
DNA replication, damage and repair
Replicons-linear, circular and D-loops, initiation of replication, DNA polymerases, helicase, primase and other enzymes and proteins used in replication, coordinating synthesis of the leading and lagging strands, Okazaki fragments, Causes of DNA damage and molecular mechanisms of repair - excision repair system in bacteria and eukaryotes, base excision, mismatch repair systems.

UNIT-II

Transcription
Prokaryotic and eukaryotic RNA polymerases, promoter sequences, start point for RNA polymerase, transcription initiation, promoter clearance and elongation, termination, attenuation and antitermination.
RNA Modifications
Split genes, concept of introns and exons, removal of Introns, spliceosome machinery, splicing pathways, alternative splicing.

UNIT- III

Inhibitors of protein synthesis. Regulation of translation.

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

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

SUGGESTED BOOKS

UNIT-I


UNIT-II

Gymnosperms: Classification and salient features; Evolutionary significance of gymnosperms. Comparative study of morphology, anatomy and reproduction of Cycadales-Cycas; Coniferales-Pinus; and Gnetales- Ephedra.

UNIT-III

Paleobotany: Fossil formation and types of fossils.

Geological time scale: sequence of plants in geological time.

Fossil Pteridophytes: Rhynia, Lepidodendron, Calamites.

Fossil gymnosperms: Williamsonia.


Suggested laboratory exercise

Pteridophytes

Study of Specimens, external morphology and T.S. of Stem of the following:
- Lycopodium: T.S. of stem
- Selaginella: T.S. of stem
Gymnosperms

External Morphology and Permanent slides of-
• *Cycas*- Coralloid roots, Rachis (T.S.), Leaflet (V.S.)  *Cycas* - Megasporophyll and Male cone with Microsporophylls, Mature Ovule.
• *Pinus*- Stem (TLS & RLS), Needle (V.S.), Male and Female Cone, Mature Ovule
• *Ephedra*- Stem (T.S.), Male and Female Flowers, Mature ovule.
• *Williamsonia*- Chart Specimen (Fossil).

Suggested Books:

UNIT-I

The basic body plan of flowering plants:
• Modular type of growth, diversity of plant forms in annuals, biennials, perennials plant.
• Branching pattern and canopy architecture.
• Morphology of Inflorescences, Flower and fruits.
Convergence of evolution of tree habit in Spermatophyta, Tissues; simple, complex and secretory tissues. tissue system.
Shoot and root systems: variation in habit and longevity.

UNIT-III

Organization of the higher plant body

Meristems and development: Shoot apical meristem, root apical meristem, lateral meristems and their functions. Range of form and structure of stem, leaf and root; their tissues and functions.

Secondary body of the plant: Secondary growth in stem and roots, Vascular cambium, secondary xylem (basic structure of wood); secondary phloem and periderm.

Anomalous secondary growth

Suggested Laboratory Exercises:
- Study of any commonly occurring dicotyledonous plant to understand the body plan and modular type of growth.
- Life forms exhibited by flowering plants (by visit to a forest or a garden).
- L.S. of shoot tip to study the organization of meristem and origin of leaf primordial.
- Monopodial and sympodial types of branching in monocots & dicots.
- Anatomy of primary and secondary growth in monocots and dicots using hand out sections of sunflower, maize, cucurbita stem and roots.
- Monocot-maize (root, stem and leaves).
- Dicot-Helianthus, Cicer and Mangifera (root, stem and leaves).
- Anamolous secondary growth in stem: Salvadoria, Bignonia, Bougainvillian, Boerhaavia, Vycantihes, Leptadenia, Dracena.
- Study of diversity in leaf shape and size. Internal structure of leaf-Dorsiventral and isobilateral leaves; study of stomatal types.

Suggested Books:
UNIT-I

Discovery of Micro-organisms: Systematic position of micro-organisms in biological world; classification of micro-organisms and characteristic features of different groups.

Methods in Microbiology: Basic principles of microscopy, micrometry, staining, sterilization methods; culture media; pure culture methods; methods for population estimation, growth determination.

Ultrastructure of Micro-organisms: Prokaryotic microorganisms; fine structure of prokaryotic cell; eukaryotic microorganisms; viruses—properties and classification; characteristic features of host-virus interaction; bacteriophage T4; tobacco mosaic virus, general account of mycoplasma.

Genetic recombination in prokaryotes: Conjugation, transformation and transduction.

UNIT-II

General account of plant pathogens: Historical developments; general account of diseases caused by plant pathogens.

Plant diseases by fungi: Rust and smuts of wheat, downy mildew and green ear disease of bajra, white rust of crucifers, late blight of potato, powdery mildew of cucurbits and grapes, red rot of sugarcane.

Pathogen attack and defense mechanisms: Physical, physiological and biochemical aspects.

Plant disease epidemiology: Transmission and spread of plant pathogens; disease cycles, epidemics: modelling and disease forecasting.

Plant disease management: Chemical, biological; IPM systems; biopesticides.

UNIT-III
Genetics of resistance and susceptibility: Genes for virulence and avirulence, their application in resistance and susceptibility; induced resistance (immunization).

Molecular plant pathology: Molecular diagnosis, identification of genes and specific molecules in disease development.

Role of micro-organisms: in biogeochemical cycling of nitrogen and carbon; biological N₂ fixation.

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

Application of information technology in plant pathology: Stimulation of epidemics; programmes for diagnosis.

Suggested laboratory exercises

Microbiology

- Sex bar body (photograph).
- Microscope and its various parts description.
- Sterilization techniques for microorganisms.
- Study of yeast, lactobacilli and cyanobacteria.
- Media preparation (Nutrient agar).
- Culturing of microorganisms by streaking on agar plates.
- Study of diseases- Citrus canker, TMV, little leaf of brinjal.
- Bacteriophage (photograph).
- Study of symptoms of virus infected plants.
- Bacterial staining in milk and curd.

Plant diseases

- White rust of crucifers - Cystopus.
- Late blight of potato - Phytophthora infestens.
- Early blight of potato - Alternaria soloni.
- Green ear disease of bajra - Sclerospora graminicola.
- Powdery mildew.
- Tikka leaf spot disease of groundnut.
- Red rot of sugarcane - Colletotrichum falcatum.

Suggested Books:

2. Biswas, S.B. and Biswas A. An introduction to Viruses, Vikas Publication

3. Clifton A. E. introduction to Bacteria, McGraw Hill Co. Ltd. New York,
1985.


5. Sharma P.D. Microbiology and pathology, Rastogi Publication, Meerut
2003.
Teaching: 3 hours per week per Theory paper.  
2 Hours per Week per Batch for Practical  
(20 candidates in each batch)

Examination:

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<thead>
<tr>
<th>Scheme</th>
<th>Min. Pass Marks</th>
<th>Max. Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>160</td>
<td>400</td>
</tr>
<tr>
<td>Paper - V</td>
<td>Real Analysis and Metric Space</td>
<td>Duration 3 hrs.</td>
</tr>
<tr>
<td>Paper - VI</td>
<td>Differential Equations</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>Paper - VII</td>
<td>Numerical Analysis and Vector Calculus</td>
<td>Theory: 2½ hrs.</td>
</tr>
<tr>
<td>Paper - VIII</td>
<td>Operations Research</td>
<td>Practical: 2 hrs.</td>
</tr>
</tbody>
</table>

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 Principal in consultation with Local Head/Head, 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 examinations separately.
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 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.

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


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 question from each Unit. All questions carry equal marks.
(ii) Non-Programmable Scientific Calculators are allowed.


Unit 3: Process of Gauss elimination and Iterative methods (Jacobi and Gauss Seidal) for solving system of linear algebraic simultaneous equations. Partial Pivoting method, ill-conditioned systems, Solutions of ordinary differential equations of first order with initial condition using Picard's Euler and modified Euler's method.

Unit 4: Scalar and Vector point functions. Differentiation and integration of vector point functions. Directional derivative, Differential operators. Gradient, Divergence and Curl. Theorems of Gauss, Green, Stokes (without proof) and problems based on these theorems.
Practical:
Teaching: 2 Hours per Week per Batch
(20 Candidates in each Batch)

Examination:

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Duration: 2 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Marks</td>
<td>32</td>
</tr>
<tr>
<td>Min. Pass Marks</td>
<td>13</td>
</tr>
</tbody>
</table>

Distribution of Marks:
Two Practicals one from each group

<table>
<thead>
<tr>
<th>10 Marks each</th>
<th>=</th>
<th>20 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Record</td>
<td>=</td>
<td>06 Marks</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>=</td>
<td>06 Marks</td>
</tr>
<tr>
<td>Total Marks</td>
<td>=</td>
<td>32 Marks</td>
</tr>
</tbody>
</table>

(i) Iteration method (ii) Newton-Raphson Method and (iii) Regula-Falsi method.

Group B: Numerical Solution of system of linear equations by Gauss elimination, 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 in Practical and Theory examinations separately.

Paper – VIII: Operations 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 5: Sequencing Models: Sequencing problems, processing n jobs through two machines. Processing n jobs through three machines, processing two jobs through m machines and processing n jobs through shortest cyclic Route Models. Minimal path problem (shortest Acyclic Route Models).
6. **Geography**

Scheme of Examination

<table>
<thead>
<tr>
<th>Paper</th>
<th>Duration</th>
<th>Subject</th>
<th>Max. Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>3 hour</td>
<td>Introduction to Political Geography</td>
<td>80</td>
</tr>
<tr>
<td>VI</td>
<td>3 hour</td>
<td>Cultural Geography</td>
<td>80</td>
</tr>
<tr>
<td>VII</td>
<td>3 hour</td>
<td>Fundamentals of Biogeography</td>
<td>80</td>
</tr>
<tr>
<td>VIII</td>
<td>3 hour</td>
<td>Statistical Methods in Geography</td>
<td>80</td>
</tr>
<tr>
<td>Practical</td>
<td></td>
<td></td>
<td>80</td>
</tr>
</tbody>
</table>

Notes

1. Students are permitted to use the stencils, simple calculator and log tables wherever needed in both theory and practical examinations.
2. There will be a common paper for Arts and Science.
3. Q.1 will be compulsory and will cover the entire course of the paper.
   Q.No. 1 of 20% marks of the maximum marks be set in two parts.
   (a) Part (a) will have ten items for locating on a map (to be supplied by examination centre) carrying 10% marks of the maximum marks and candidates shall attempt any five items.
   (b) Part (b) will have 10 short answer questions carrying 10% marks of the maximum marks and candidates shall attempt any five items.
4. Remaining 9 questions carrying equal marks will be set with three questions from each section of the syllabus.
5. Candidate will attempt 5 questions including question No. 1 in all selecting at least one question from each section.
6. Practical examination will be conducted by the board of examiners.
7. The candidate will have to pass in theory and practical separately.

**SYLLABUS**

**Paper V: Introduction to Political Geography**

Section A

Meaning, nature, scope and subject matter of political geography, political geography and critical geopolitics, approaches to the study of political geography, morphological, functional
and united field theory, role of physical, demographic, economic, socio-cultural and historical factors in the emergence of states.

Section B

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

Section C

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

Recommended Readings:

सक्सेना, एच.एम. 2009–10: राजनैतिक भूगोल। स्पेसीज़ प्रेजेंटेशन्स, मेंस्टर।

Paper VI: Cultural Geography

Section A

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

Dy. Registrar (Acad), University of Rajasthan
Jaipur
Section B

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

Section C

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

Recommended Readings:


Paper VII: Fundamentals of Biogeography

Section A

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

Section B

Origin of fauna and flora: geographical distribution, major gene-centres 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

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

Recommended Readings:


पुर्व, आर.के. एवं जाट, श्री.सी. 2012: पर्यावरण भूगोल। पंचवीं प्रकाशन, जयपुर।


सिंह, एस. 2013: जीव भूगोल। प्रयाग पुस्तक भवन, इलाहाबाद।

Paper VIII: Statistical Methods in Geography

Section-A

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

Section-B

Measures of central tendency: median, mode, arithmetic mean and geometric mean, measure of variations of dispersion: crude range, quartile deviation, standard deviation, Coefficient of variation, normal curve, measures of Skewness: Kurtosis, simple correlation and regression.
Section-C

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

Books Recommended:

Practicals

Scheme of examination

<table>
<thead>
<tr>
<th></th>
<th>Min. Pass Marks: 32</th>
<th>Max. Marks: 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written test</td>
<td>40</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>Field survey and viva voce</td>
<td>15+5</td>
<td>2½ hrs.</td>
</tr>
<tr>
<td>Record and viva voce</td>
<td>15+5</td>
<td></td>
</tr>
<tr>
<td>Total Marks</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

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

SYLLABUS

Section A

Maps and diagrams: one dimensional (bar & pyramid), two dimensional (square, rectangle, wheel, circles & ring), three dimensional diagrams (cube, sphere and block,pile), distributional maps: dot, isopleth, choropleth, chorochromatic and chroschematic.
Measures of central tendency & dispersion: mean, median and mode, mean deviation, quartiles & standard deviation.

Section C

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

Recommended Readings:


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

## SCHEME OF EXAMINATION:

<table>
<thead>
<tr>
<th>Papers</th>
<th>Nomenclature</th>
<th>Duration</th>
<th>Max. Marks</th>
<th>Min. Pass Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper-V</td>
<td>Systems and Theories of Psychology</td>
<td>3 Hrs.</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Paper-VI</td>
<td>Psychopathology</td>
<td>3 Hrs.</td>
<td>75</td>
<td>120</td>
</tr>
<tr>
<td>Paper-VII</td>
<td>Counselling Psychology</td>
<td>3 Hrs.</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Paper-VIII</td>
<td>Biological Basis of Behaviour</td>
<td>3 Hrs.</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Practicals</td>
<td></td>
<td>3 Hrs.</td>
<td>100</td>
<td>40</td>
</tr>
</tbody>
</table>

**NOTE:**

1. There will be four theory Papers in Psychology in B.A. Honour Part-I. It would be common for Arts and Science. Each paper will be of 3 hours. It would comprise 3 Sections A, B and C and would cover the entire course content of the paper.

   - **Section-A** will contain 10 questions of 20 words consisting of 1.5 marks each. Thus, Part-A will be of 15 marks.
   - **Section-B** will contain 7 questions of 50 words each, out of which students are required to attempt 5 questions. Each question will be of 3 marks. Thus, Part-B will be of 15 marks.
   - **Section-C** will contain 3 long questions each with internal choice. Each question will be of 15 marks. Thus, Part-C will be of 45 marks.

For clarification the distribution of marks is tabulated as below:

<table>
<thead>
<tr>
<th>B.A. Honours (Psychology) Part-I</th>
<th>No. of Questions</th>
<th>Marks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10</td>
<td>1.5</td>
<td>15</td>
</tr>
<tr>
<td>B</td>
<td>5 (Out of 7)</td>
<td>03</td>
<td>15</td>
</tr>
<tr>
<td>C</td>
<td>3 (with internal choice)</td>
<td>15</td>
<td>45</td>
</tr>
<tr>
<td>Total Marks</td>
<td></td>
<td></td>
<td>75</td>
</tr>
</tbody>
</table>

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

[Signature]

Dy. Registrar (Acad.)
University of Rajasthan
JAIPUR
Paper-V:
Systems and Theories of Psychology

Section-A

3. Functionalism: William James, Galton and Cattell

Section-B

4. Behaviorism: Thorndike, Pavlov, Watson and Tolman
5. Gestalt Psychology: Wertheimer, Koffka and Kohler.

Section-C

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

Books Recommended:

Paper-VI:

Psychopathology

Section-A


2. Theoretical Perspectives: Biological, Psychodynamic, Behavioural, Cognitive, Humanistic, Existential, Community-Cultural and Interactional.

3. Symptomatology and Etiology of Abnormal Behaviour: Cognitive, Cognitive and Affective Symptoms; Biological, Psycho-Social, Socio-cultural Causes

Section-B


Section-C

7. Schizophrenia and other Psychotic disorders: Nature; Clinical Picture and Types.

8. Mood Disorders and Substance Related Disorders: Nature and Clinical Picture of Depression, Depressive and Bipolar Disorders. Nature of Substance-Use and Substance-Induced Disorders; Clinical Picture of Alcohol-related, Nicotine-related and Sedative-Hypnotic/Anxiolytics-Related Disorders.

Books Recommended:

- Arun Kumar Singh (2002), Adhunik Asamanya Manovigyan, Delhi, Motilal Banarsidas.

Paper-VII:

Counselling Psychology

Section-A

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

2. Counselling Process; Counselling Relationships: Nature and Determinants; Steps of Counselling Process; Initial Interview: Types and Conduction, Exploration and the Identification of Goals.

3. Personal and Professional Aspects: Personality and Background of the Counsellor; Professional Counselling - related activities; Ethical and legal aspects: Ethics, morality, law, and Counselling, Professional Codes of Ethics and Standards; Ethical decisions.

Section-B


Section-C

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

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


Books Recommended :


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


Paper-VIII:

Biological Basis of Behaviour

Section-A

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

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

Section-B

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

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

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

Section-C

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

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

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

Books Recommended:


Practicals:

1. Method of Average Error - Muller Lyer Illusion
2. Biofeedback
3. Experiment on Classical Conditioning
4. Measurement of Emotions by Facial Expression
5. Word Association Test
6. High School Personality Questionnaire
7. Thematic Apperception Test
8. Level of Aspiration
9. Wechsler Adult Intelligence Scale
10. Neuropsychological Assessment
11. Assessment of Mental Health
12. PGI Battery of Memory Dysfunction