University of Rajasthan
Jaipur

SYLLABUS

B.Sc. (Hons.) Part-II

Examination - 2019
### CONTENTS

**S. No.** | **Name of the Subject and Paper**
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**Scheme of Examination**
- Syllabus (Subsidiary Subjects)
  - (Same Courses of Study as prescribed for Part-II T.D.C. Pass Course)
- Syllabus (Honours Subjects)
  1. Physics
  2. Chemistry
  3. Zoology
  4. Botany
  5. Mathematics
  6. Geography
  7. Psychology

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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


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 birefringence experiment. Interference of waves from several synchronous sources. Directional transmission and reception of radio signals.


Unit-II Fraunhofer Diffraction

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

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


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. Xhandelwal
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 systems. 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 Harvili (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, 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

Unit-III


Unit-IV


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) Eigenvalues 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:

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

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.
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, Colpitt, 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 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 Vleck: Network Analysis
6. J.D. Ryder: Network Analysis

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
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 efn by Thomson's method.
## CHEMISTRY

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<td>Practical</td>
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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 $\mu$ 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, Orgel-energy level diagrams for d$^1$ and d$^2$ states, discussion of the electronic spectrum of [Hg(H$_2$O)$_4$]$^{2+}$ 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 ions.
UNIT-V

Oxidation and Reduction:

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 SO₃.

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

Unit-I

Alcohols
Classification and nomenclature.
Phenols

Ethers and Epoxydes

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
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 nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.
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 C₂H₅Br, C₂H₅OH, CH₃CHO, 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) Hittorf'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 auxochrome. 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
UNIT-I

Chromatography: Principles of absorption and partition chromatography, techniques and application of column, paper and thin layer chromatography. Electrophoresis and its applications in separation of amino acids.
Ion exchange methods: General discussion, action of ion exchange resins, column operation, experimental techniques, types of ion exchange resins, determination of the following pairs by ion exchange techniques: (a) chloride and bromide (b) nickel and cobalt.

UNIT-II

Conductometric titrations: The basis of conductometric titrations. Apparatus and measurement, application of conductometric titrations. High frequency titrations, advantages of the techniques, some examples of high frequency titrations.
Potentiometric titrations: Introduction, electrodes, instrumentation, potentiometric titrations, differential potentiometric titrations, automatic potentiometric titrations, location of end points, determination of some metals through potentiometric titrations.

UNIT-III

Spectrophotometric titrations: Basic principle, instrumentation experimental techniques, spectrophotometric analysis of Fe (III), Co (I), Ni (II), Fe (II) in presence of Al (III) with EDTA.
Nephelometry & Turbidimetry: General discussion, instrumentation, some nephelometry determination (a) sulphate (b) phosphate.

UNIT-IV

Flame emission and Atomic absorption spectrometry: Basic principle, instrumentation. Nebulization, flames and flame temperatures, interferences. flame spectrometric techniques.
Atomic emission spectrography: Spectroscopic sources, instruments for emission spectrographic analysis, qualitative and quantitative spectrographic analysis. Qualitative spectrographic analysis of a non ferrous alloy and complex organic mixture.

UNIT-V

B.Sc. (Hons.) Pt.-II Chemistry Practical
(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) Chloropentamminecobalt(III) chloride.
(b) Cuperous chloride, Cu₂Cl₂.
(c) Tetramminecopper(II) sulphate.
(d) Pyridine complex of copper
(e) Prussian blue.
(f) Hexaamminenickel(II) chloride.

Organic Chemistry

(i) Identification of simple organic compound and preparation of its suitable derivative.
(ii) Simple one step organic preparation-the students are expected to perform at least five of the following preparations:

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

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
1. To find out the strength of strong acid by titrating it against strong alkali.
2. To find out the strength of weak acid by titrating it against a strong alkali.
3. To find out the strength of hydrochloric acid and acetic acid in a mixture of both, by titrating it against sodium hydroxide.
4. 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
University of Rajasthan
Syllabus: B.Sc. Zoology (Hons.) Part-II
(2018-19)

Scheme:
Paper VII: Animal Diversity -3
Paper VIII: Animal Diversity -4
Paper IX: Physiology -1
Paper X: Physiology -2
Paper XI: Immunology
Paper XII: Ethology
Practicals: 2 Days (8Hrs.)
Max. Marks-50
Max. Marks-50
Max. Marks-50
Max. Marks-50
Max. Marks-50
Max. Marks-50
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, Interalrelations, Structural organisation of Hemichordates, Urochordates and Cephalochordates and their affinities.
3. Agnatha – Classification up to 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

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

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.

Dy. Registrar
(Academic)
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JAIPUR
Paper-VIII: Animal Diversity

Max. Marks: 50

Scheme of Examination:

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–1

Max. Marks: 50

Scheme of Examination:

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 urotocele), 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 polikilothersms 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 - XII: Immunology

Scheme of Examination: \[ \text{Max. Marks: 50} \]

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.

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.
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.

Paper - XII: Ethology

Scheme of Examination: \[ \text{Max. Marks: 50} \]

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. History and Introduction to animal behaviour (ethology), brief idea about works of Nobel prize winners - Konrad Lorenz, Karl Von Frisch and Niko Tinbergen.
2. Classical concepts of Ethology- fixed action patterns, sign stimulus, innate releasing mechanism, action specific energy; flush toilet model.

Section - B

4. Orientation- types of Taxes and Kinesis; navigation in migratory birds.
5. Different types of Biological clocks.
6. Feeding strategies among animals.
7. Pheromones in animal kingdom, their functions.

Section - C

8. Sociobiology- cooperation, reciprocation and altruism; social groups of non human primates.
9. Reproductive strategies among animals.
10. Parental care in animals.

Section - D

11. Difference between learned and unlearned behaviours, types of learning- habituation, trial and error, conditioning and Imprinting.
12. Wild life of Rajasthan- national parks, tiger reserves, projects related to state animal and state bird. Habitat, scientific and common names of 20 wild animals.

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

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

Practicals

I. Anatomy: Study of the following with dissection

- Any edible fish (Wallago / Labeo): Afferent & efferent branchial arteries, cranial nerves, eye muscles, Weberian ossicles and internal ear.
- Accessory respiratory organs: Heteropneustis, Anabas, Ophiocephalus and Clarius.
- Any edible fish: Afferent & efferent branchial arteries, cranial nerves, eye muscles and internal ear.

II. Museum specimens:


Dy. Registrar (Academic)
University of Rajasthan
Jaipur
Rhacophorus, Chelone, Testudo, Hemidactylus, Varamus, Phrynoma, Draco, Chameleon, Sphenodon, Mabuya, Eryx, Hydrophis, Viper, Naja, Krait, Crocoddilus, Alligator, Gavialis, Archaeopteryx, Peacock, Ostrich, Emu, Ornithorhynchus, Tachyglossus, Didelphis, Shrew, Kangaroo, Bat, Manis, Loris, Presbytis and Macaca.

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

IV. Study of permanent microscopic slides:


V. Permanent preparation:

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

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

VII. Physiology

(i) Blood: Haemoglobin and Haematocrit estimation, 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).

VIII. Immunology

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

IX. 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.

X. Educational tour to museum of natural history/sea shore/wild life sanctuary/Zoo for collection/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

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

<table>
<thead>
<tr>
<th>Min marks: 20</th>
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<tbody>
<tr>
<td><strong>1st day</strong></td>
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<tr>
<td>1. Anatomy</td>
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<td>• Major</td>
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<tr>
<td>• Minor</td>
<td></td>
</tr>
<tr>
<td>2. Permanent preparation/microtomy</td>
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<tr>
<td>3. Exercise in Immunology</td>
<td>05</td>
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<tr>
<td>4. Identification and Comments on spots (1 to 8)</td>
<td>16</td>
</tr>
<tr>
<td>5. Viva voce</td>
<td>5</td>
</tr>
<tr>
<td>6. Class record</td>
<td>5</td>
</tr>
<tr>
<td>7. Seminar/Project Report/Collection</td>
<td>5</td>
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</table>

<table>
<thead>
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<tbody>
<tr>
<td><strong>2nd day</strong></td>
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<tr>
<td>1. Exercise in Physiology</td>
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<tr>
<td>(a) Major</td>
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<tr>
<td>(b) Minor</td>
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<tr>
<td>2. Exercise in Ethology</td>
<td>05</td>
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<tr>
<td>3. Identification and Comments on spots (1 to 8)</td>
<td>16</td>
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<tr>
<td>4. Viva voce</td>
<td>5</td>
</tr>
<tr>
<td>5. Class record</td>
<td>5</td>
</tr>
</tbody>
</table>

- Anatomy: Study of systems of the prescribed types with the help of dissection. With reference to anatomy, 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.
- With reference to microscopic slides/whole mounts and museum specimens in case of unavailability, the animal types should be substituted with diagrams/photographs/models etc.
- Students will keep records of all work done in the practical records.
- It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.
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

Translation: Protein synthesis in Prokaryotes and Eukaryotes: Assembly line of polypeptide synthesis, ribosome structure and assembly, various steps in protein synthesis -- tRNA, mRNA, aminoacyl tRNA synthetases. Proteins involved in translation - elongation, initiation and termination of polypeptide. Fidelity of translation.
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

Suggested laboratory exercise
Pteridophytes
Study of Specimens, external morphology and T.S. of Stem of the following:
- Lycopodium Stem
- Selaginella 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.
- **Williamsia**- Chart Specimen (Fossil).

**Suggested Books:**


6. 

| VII | Paper - Morphology and Anatomy of Angiosperms |

**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 secretary 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).
- Anomalous secondary growth in stem: Salvadoria, Bignonia, Bougainvillia, Boerhaavia, Atractylodes, 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 defence 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.
Genes 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 cells body (photograph).
- Microscope and its various parts description.
- Sterilization techniques for microorganisms.
- Study of yeast, lactobacilli and cyanobacteria.
- Media preparation (Nutrient agar).
- Culture of microorganisms by streaking on agar plates.
- Study of diseases - Citrus canker, 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 infestans*.
- Early blight of Potato - *Alternaria soloni*.
- Green stem disease of bajra - *Sclerospora graminicola*.
- Powdery mildew
- Okra leaf spot disease of groundnut.
- Fruiting of sugarcane - *Colletotrichum fulvum*.

Field Study of Plants in farmers field / Agricultural Stations.

Suggested Books:
1. Prakash, S.B. and Biswas, A. An introduction to Viruses. Vikas Publication
2. Cutten A. C. Introduction to Bacteria, McGraw Hill Co. Ltd. New York,
4. Sharma P.D. Microbiology and pathology, Rastogi Publication, Meerut
2003.
# MATHEMATICS

**Teaching:** 3 Hours per Week per Theory Paper.
2 Hours per Week per Batch for Practical
(20 candidates in each batch)

**Examination:**

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Min. Pass Marks</th>
<th>Max. Marks</th>
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<tbody>
<tr>
<td>Science – 54</td>
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<td>150</td>
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<tr>
<td>Arts – 72</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td><strong>Paper – I</strong></td>
<td><strong>Real Analysis and Metric Space</strong></td>
<td><strong>Duration</strong> 3 hrs.</td>
</tr>
<tr>
<td><strong>Paper – II</strong></td>
<td><strong>Differential Equations</strong></td>
<td><strong>3 hrs.</strong></td>
</tr>
<tr>
<td><strong>Paper – III</strong></td>
<td><strong>Numerical Analysis and Vector Calculus</strong></td>
<td><strong>3 hrs.</strong></td>
</tr>
<tr>
<td>Practical</td>
<td><strong>Numerical Methods</strong></td>
<td><strong>2 hrs.</strong></td>
</tr>
</tbody>
</table>

**Note:**

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

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

3. An Internal/external examiner can conduct Practical Examination of not more than 100 (Hundred) Candidates. (20 candidates in each batch)

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

_Dy. Registrar (Academic)_
*University of Rajasthan, Jaipur*
Paper – I: Real Analysis and Metric Space  
Teaching : 3 Hours per Week  
Duration of Examination : 3 Hours  
Max. Marks: 40 (Science)  
33 (Arts)  

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 3: Notion of limit, continuity and differentiability 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 5: Metric space – Definition and examples. Open and Closed sets, Interior and Closure of a set, Limit point of a set. Subspace of a metric space, Product space, Continuous mappings. Sequence in a metric space, Cauchy sequence.

Reference Books:
5. Charles G. Denlinger, Elements of Real Analysis, Jones and Bartlett (Student Edition), 2011.
Paper – II: Differential Equations
Teaching: 3 Hours per Week
Duration of Examination: 3 Hours

Max. Marks: 40 (Science)
53 (Arts)

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.


Reference Books:
Paper - III: Numerical Analysis and Vector Calculus  
Teaching : 3 Hours per Week  
Duration of Examination : 3 Hours  
Max. Marks: 40 (Science)  
54 (Arts)

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


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

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

Reference Books:

(4)
Practical: Numerical Methods
Teaching: 2 Hours per Week per Batch

Examination:  
Duration: 2 Hours

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<thead>
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<th>Scheme</th>
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<th>Arts</th>
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<tr>
<td>Max.Marks</td>
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<td>40</td>
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<tr>
<td>Min.Pass Marks</td>
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<td>13</td>
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Distribution of Marks:

Two Practicals one from each group

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<td>10 Marks each</td>
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<td>Practical Record</td>
<td>05 Marks</td>
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<td>Viva-voce</td>
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<td>07</td>
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<tr>
<td>Total Marks</td>
<td>30 Marks</td>
<td>40</td>
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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.
6. Geography

Scheme of Examination

Min. Pass Marks 160 (40%)  
Max. Marks 400

Paper - V 3 hour duration  Introduction to Political Geography  Max. Marks 80
Paper - VI 3 hour duration  Cultural Geography  Max. Marks 80
Paper - VII 3 hour duration  Fundamentals of Biogeography  Max. Marks 80
Paper - VIII 3 hour duration  Statistical Methods in Geography  Max. Marks 80
Practical

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. Q1 will be compulsory and will cover the entire course of the paper.
   Q1: 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:

स्वामिनाथा, एच.एल. 2009-10: राजनीतिक भूगोल. एडिटर्स प्रेस, मेरिल्ड.

Paper VI: Cultural Geography

Section A

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

Evolution of civilization: with special reference to mesopotamian, nile, indus and 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 modernization, technological changes and their spatial implications, social structure and technology, pattern of rural and urban society, social processes in the city, the city in the developing countries.

Recommended Readings:


Husain, M. 2007, Models in Geography. Rawat Publications, Jaipur


Rabinow, N.J. 2000: सांस्कृतिक भूगोल। शास्त्र पुस्तक भवन, इलाहाबाद।


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. Darwin’s theory of evolution, concept of biome and community.

Section B

Origin of fauna and flora, geographical variation, major geocenters, domestication of plants and animals, and their dispersal; distribution of plant life on the earth and its relation...
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 wetlands, agricultural ecosystems with specific reference to the Indira Gandhi National Pariyojna (IGNP), industrial effluent and its effect on fresh water biology and riverine ecosystem management practice (special reference to Rajasthan).

Recommended Readings:


सिंह, एस. 2013: जैव ज्ञान। प्रयाग पुस्तक भवन, अल्लाहाबाद।

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 (give).

Section B

Measures of central tendency: mean, median, arithmetic mean and percentile, mean deviation, standard deviation, coefficient of variation, measures of skewness. Correlation, 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>Min. Pass Marks: 32</th>
<th>Marks</th>
<th>Max Marks: 80</th>
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</thead>
<tbody>
<tr>
<td>Written test</td>
<td>40</td>
<td>Time</td>
</tr>
<tr>
<td>Field survey and viva voce</td>
<td>15+5</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>Record and viva voce</td>
<td>15+5</td>
<td>21/2 hrs.</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, elec, chromatic and chorochromatic.
Section B

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

Section C

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

Recommended Readings:


वर्ग, जे.पी. 2012; प्रायोगिक भूगोल। रस्तोगी पब्लिकेशन्स, मेरठ।

**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>Section</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></td>
<td>Total Marks</td>
<td></td>
<td>75</td>
</tr>
</tbody>
</table>

A Scientific or Graphing Calculator will be allowed for the examination of all papers.
Paper V:

Systems and Theories of Psychology

Section A

2. Structuralism: Wundt and Titchener.
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:


Dv. Registrar

50
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


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.

Treatment and Prevention: Psychotherapies Client-Centered, Cognitive, Psychoanalytic, Behavioral Therapies, Prevention, Level Situation-Focused and \[\text{51}\]
Books Recommended:


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 Conduct, 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 :


Paper-VIII:

Biological Basis of Behaviour

Section-A

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

Cell 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; Hormones and Emotion.

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

Books Recommended:


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