

Ordinance, Syllabus and Scheme of Examination

B.Sc. (Hons.) Course

Scheme of Examination

1. It is a three year degree programme. Examination shall be conducted at the end of each year as per academic calendar notified by the university.
2. There will be two components of the examination: (a) Internal Assessment (IA), & (b) External or Term End examination (EA). The weight of IA will be 20 percent and EA will be 80 percent in each paper unless otherwise specified.
The minimum marks required to pass any subject in an examination shall be 36% in aggregate in each subsidiary subject and 40% marks in the Honours subjects/papers taken together in theory. It will be essential to pass in separately in practical separately wherever prescribed.
3. Students who do not obtain the required minimum percentage shall be declared fail and will be eligible for reappear next year. However, they will have the option to retain the marks in the papers in which they have secured pass marks i.e. 36% or more in subsidiary subjects and 40% or more in Honours subjects. There will be no supplementary examination.
4. In case of re- appearance the result will be prepared on the basis of the candidate's current performance.
5. Re-appearance in passed practical is not permitted.
6. The duration of the under graduate degree programme is 3 years and post graduate examination is 2 years. The time span period to complete the course shall be t+2 years from the year of admission. Where t is the minimum period of the programme.
7. **The term-end examination papers will be divided into 3 Sections.**
8. The number of papers and the maximum marks for each paper together with the minimum marks required for a pass are shown against each subject separately in the table given below.
9. Division will be awarded at the end of final year examinations as follows: First Division 60% and Second Division 48% of the aggregate marks prescribed at (a) Part I (b) Part II Examination, and (c) Part III examination taken together. All the rest shall be declared to have passed the examination, if they obtain the minimum pass marks in each subject. No division shall be awarded at the Part I and Part II of the under graduate examination.
10. However the marks obtained in compulsory papers will not be counted while awarding the division.
11. Students of B.Sc. will have to select 1 Hons. Subject and one subsidiary subject from the list. The syllabi of the compulsory subjects will be same as B.A./B.Sc./B.Com. (pass) course
12. The Syllabi of the subsidiary subject selected by the candidate will be same as mentioned in the B.Sc.Pass course syllabus of Part-I , Part-II, and Part-III.

Compulsory Qualifying Subjects in undergraduate Programme: (B.Sc. Hons.)

1. General Hindi
2. General English
3. Elementary Computer Applications
4. Environmental Studies

Note: Scheme of Examination, Distribution of Marks and Syllabus of the compulsory qualifying subjects in B.Sc. (Hons.) is same as in B.Sc. (Pass) course.

Students have to select one honours subject and one subsidiary subject from the list while seeking admission in B.Sc (Hons.) Part I.

1. Physics

2. Chemistry
3. Mathematics
4. Zoology
5. Botany

Note: Syllabus and scheme of Examination the subsidiary course of study and the text books for subsidiary subjects of honours examination shall be the same as prescribed for the B.Sc. pass course subjects. The Distribution of Marks in B.Sc. (Hons) course unless specified otherwise shall be as under:

Distribution of Marks

Any one of the following subjects is to be selected by the student as at the time of admission in B.Sc.(Hons) Part-I. Subjects once selected at the time of admission will not be changed.

S.No.	Name of the Subject	Paper	Duration	Internal		External		Total	
				Max	Min	Max	Min	Max	Min
1-	Physics	I	3	15	6	60	24	75	30
		II	3	15	6	60	24	75	30
		III	3	15	6	60	24	75	30
		IV	3	15	6	60	24	75	30
		Practical	2 days 5 hrs.					100	40
2-	Mathematics	I	3	17	7	68	27	85	34
		II	3	17	7	68	27	85	34
		III	3	17	7	68	27	85	34
		IV	3	17	7	68	27	85	34
		Practical	2					60	24
3-	Zoology	I	3	10	4	40	16	50	20
		II	3	10	4	40	16	50	20
		III	3	10	4	40	16	50	20
		IV	3	10	4	40	16	50	20
		V	3	10	4	40	16	50	20
		VI	3	10	4	40	16	50	20
		Practical	2days 8 hrs.					100	40
4-	Botany	I	3	15	6	60	24	75	30
		II	3	15	6	60	24	75	30
		III	3	15	6	60	24	75	30
		IV	3	15	6	60	24	75	30
		Practical	6					100	40

NOTE:

(i) The Marks secured in the paper of Gen Hindi or Gen. English and Computer Applications and Environmental Studies shall not be counted in awarding the division to a candidate.

(ii) The candidates have to clear compulsory papers in three chances.

(iii) Non-appearing or absent in the examination of compulsory paper will be counted a chance.

B.Sc. (Hons.) PART-I

1. PHYSICS

S.No.	Paper	Name of the Paper	Duration in Hours
1.	I	Mechanics	3
2.	II	Mathematical Physics	3
3.	III	Electricity and Magnetism	3
4.	IV	Thermodynamics and Statistical Physics	3
5.	-	Practical (2 Days hrs.)	5

PAPER I: MECHANICS

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

Unit: I

Fundamentals of Dynamics: Reference frames, Inertial frames, Galilean transformations, Galilean invariance. Review of Newton's Laws of Motion, Dynamics of a system of particles. Centre of Mass, Principle of conservation of momentum, Impulse, Momentum of variable-mass system: motion of rocket.

Non-Inertial Systems: Non-inertial frames and fictitious forces, Uniformly rotating frame, Laws of Physics in rotating coordinate systems, Centrifugal force, Coriolis force and its applications, Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.

Unit: II

Special Theory of Relativity: Michelson-Morley Experiment and its outcome, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Length contraction, Time dilation, Relativistic transformation of velocity, frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Mass less Particles, Mass-energy Equivalence, Relativistic Doppler Effect, Relativistic Kinematics, Transformation of Energy and Momentum, Energy Momentum Four Vector.

Unit: III

Gravitation and Central Force Motion: Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere.

Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, The energy equation and energy diagram, Kepler's Laws, Satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS), Physiological effects on astronauts.

Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames.

Unit: IV

Work and Energy: Work and Kinetic Energy Theorem, Conservative and non-conservative forces, Potential Energy, Energy diagram, Stable and unstable equilibrium, Elastic potential energy, Force as gradient of potential energy, Work & Potential energy, Work done by non-conservative forces, Law of conservation of Energy.

Elasticity: Relation between Elastic constants, twisting torque on a Cylinder or Wire.

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube.

Unit: V

Rotational Dynamics: Angular momentum of a particle and system of particles, Torque, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of Inertia, Calculation of moment of inertia for rectangular, cylindrical and spherical bodies, Kinetic energy of rotation, Motion involving both translation and rotation.

Oscillations: SHM: Simple Harmonic Oscillations, Differential equation of SHM and its solution, Kinetic energy, potential energy, total energy and their time-average values, Damped oscillation, Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor.

Suggested Books:

1. An introduction to mechanics by Daniel Kleppner, Robert J. Kolenkow (McGraw-Hill, 1973)
2. Mechanics Berkeley physics course, v.1: By Charles Kittel, Walter Knight, Malvin Ruderman, Carl Helmholtz, Burton Moyer, (Tata McGraw-Hill, 2007)
3. Mechanics by D S Mathur (S. Chand & Company Limited, 2000)
4. Mechanics by Keith R. Symon (Addison Wesley; 3 edition, 1971)
5. University Physics by F W Sears, M W Zemansky and H D Young (Narosa Publishing House, 1982).

PAPER II MATHEMATICAL PHYSICS

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

Unit: I

Recapitulation of vector, properties of vector under rotation, scalar product and its invariance under rotation, vector product scalar triple product and their interpretation in terms of area and volume respectively, scalar and vector fields.

Unit: II

Vector Differentiation, Gradient of a scalar field and its geometrical interpretation, Divergence and Curl of a vector (polar, cylindrical and spherical), Del and Laplacian operator, Jacobian, flux of a vector field, Gauss divergence theorem, Green theorem, Stokes theorem and their applications.

Unit: III

First order differential and integrating factor, Second order differential, Homogenous equations with constant coefficients, Wronskian and general solution, statement of existence and uniqueness theorem for initial value problems, particular integral.

Unit: IV

Calculus of functions of more than one variable, partial derivative, geometrical interpretation of total differential of a function of two and three variables, Higher order derivative and their applications.

Unit: V

Definition of Dirac delta function, Representation and limit of a Gaussian, function and rectangular function, Properties of Dirac delta function.

Suggested Books:

1. Matrices and Tensors in Physics by A.W. Joshi . (New age int. Pub., 1995)
2. Vector Space and Matrices in Physics by M.C. Jain (Alpha Science International Ltd, 2007)

3. Methods of Mathematical Physics: Partial Differential Equations by R. Courant & D. Hilbert. (New Delhi Wiley India, 2008)

4. Mathematical physics by H.K. Dass and S. Chand

PAPER III: ELECTRICITY AND MAGNETISM

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weightage will be given to problems and numerical.

Unit: I

Coulomb's law, calculations of E for simple distributions of charges at rest, Dipole and Quadrupole fields, Work done on a charge in an electrostatic field, conservative nature of electrostatic field, Electric potential, relation between electric field and electric potential, torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding E for symmetric charge distributions, Gaussian pillbox, Field at the surface of conductor, Screening of E field by conductor, capacitors, electrostatic field energy, force per unit area of the surface of conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor, Method of images and its application to: plane infinite sheet and sphere.

Unit: II

Dielectrics, Parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, displacement vector D, molecular interpretation of Clausius-Mossotti equation, boundary conditions satisfied by E and D at the interface between two homogeneous dielectrics: illustration through simple examples, Electrical susceptibility, Relation between E, P and D, Gauss's law in dielectrics.

Unit: III

Steady current, Current density J, Non-steady currents and continuity equation, Kirchhoff's law and analysis of multiloop circuits, rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits, AC circuit problems, complex impedance and reactance, Measurement of capacitance using impedance at different frequencies, series and parallel resonance, Q factor, power consumed by an AC circuit, power factor, Y and π -networks and transmission of electric power.

Unit: IV

Magnetic Field: Magnetic force between current elements and definition of Magnetic Field B, Biot-Savart's Law and its simple applications: straight wire and circular loop, Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B: curl and divergence, Vector Potential, Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements, Torque on a current loop in a uniform Magnetic Field.

Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Ferromagnetism, B-H curve and hysteresis.

Unit: V

Electromagnetic Induction: Faraday's Law, Lenz's Law, Self Inductance and Mutual Inductance, Reciprocity Theorem, Energy stored in a Magnetic Field, Introduction to Maxwell's Equations. Charge Conservation and Displacement current.

Suggested Books:

1. Electricity & Magnetism by A.S. Mahajan & A.A. Rangwala (Tata Mc Graw Hill)
2. Fundamentals of Electricity and Magnetism by Arthur F. Kipp.

3. Electricity and Magnetism, Berkeley Physics course, vol. 11 by E.M. Purcell
4. Electricity & Magnetism, 4th Edition, W.J. Duffin .

PAPER IV: THERMODYNAMICS AND STATISTICAL PHYSICS

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

UNIT-1

THERMODYNAMICS

The laws of thermodynamics: The Zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as state function and other applications. Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics Different versions of the second law, practical cycles used in internal combustion engines. Entropy, principle of increase of entropy. The thermodynamic scale of temperature; its identity with the perfect gas scale. Third law of thermodynamics.

UNIT-2

Thermodynamic relationships: Thermodynamic variables; extensive and intensive, Maxwell's general relations, application to Joule-Thomson cooling and adiabatic cooling in a general system, Van-der Waals gas, Clausius Clapeyron heat equation.

Thermodynamic potentials and equilibrium of thermodynamic systems, relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

UNIT-3

Blackbody radiation: Pure temperature dependence. Stefan-Boltzmann law of radiation. Spectral distribution of blackbody radiation. Wien's displacement law, Rayleigh-Jean's law, the ultraviolet catastrophe, Planck's quantum postulates, Planck's law, complete fit with experiment. Interpretation of behavior of specific heats of gases and solids at different temperature.

UNIT-4

Classical Statistics: Macro State & Micro State, Elementary concept of ensembles, Phase Space, Entropy & Thermodynamic Probability, Maxwell Boltzmann Distribution Law, Partition Function, Thermodynamic Function Of Ideal gas, Classical entropy expression, Gibbs Paradox, Sackur-Tetrode Equation, Law of Equipartition of energy, Application to Specific heat and its limitations, Thermodynamic Function of a two energy level system, Negative Temperature.

UNIT-5

Bose-Einstein Statistics: B-E Distribution Law, Thermodynamic function of a strongly degenerate Bose gas, Bose Einstein Condensation, Properties of Liquid Helium(Qualitative description) , Radiation as a Photon gas & Thermodynamic Function of a Photon gas, Bose derivation of Planck's Law.

Fermi-Dirac Statistics: F-D Distribution Law, Thermodynamic function of a strongly degenerate Fermi gas, Fermi energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, White Dwarf Stars, Chandrasekhar Mass limit.

Suggested Books:

1. Thermodynamics by Enrico Fermi (Courier Dover Publications, 1956)
2. A Treatise on Heat: Including Kinetic Theory of Gases, Thermodynamics and Recent Advances in Statistical Thermodynamics By Meghnad Saha, B. N. Srivastava (Indian Press, 1958)

3. Heat and Thermodynamics: An Intermediate Textbook By Mark Waldo Zemansky, Richard Dittman (McGraw-Hill, 1981)
4. Thermal Physics by Garg, Bansal and Ghosh (Tata McGra-Hill, 1993)
5. Statistical Physics: Berkeley Physics Course Volume 5 by F Reif (Tata McGraw-Hill Company Ltd, 2008)
6. Statistical and Thermal Physics: an introduction by S.Lokanathan and R.S.Gambhir(P.H.I., 1991).
7. Statistical Mechanics by R. K. Patharia (Oxford: Butterworth, 1996).

PHYSICS PRACTICALS

Total number of experiments to be performed by the students during the session should be 16, selecting any eight from each section. In examination two experiments are to be performed taking at least one from each section.

Section : A

1. Study of laws of parallel and perpendicular axes for moment of inertia.
2. To find M.I. of an irregular body by inertia table.
3. Study of conservation of momentum in two dimensional oscillations.
4. Study of a compound pendulum.
5. Study of damping of a bar pendulum under various conditions.
6. Study of oscillations under a bifilar suspension.
7. Potential energy curves of a 1 -dimensional system and oscillations in it for various amplitudes.
8. Study of oscillations of a mass under different combinations of springs.
9. Study of bending of a cantilever or a beam.
10. Study of torsion of a wire (static and dynamic methods)
11. Study of flow of liquids through capillaries.
12. Determination of surface tension of a liquid by different methods.
13. Study of viscosity of a fluid by different methods.
14. Determine Y by Hook's law
15. Determine Y , η , σ by Searle's apparatus
16. Determine η by Maxwell needle
17. Determine η by Statical method
18. Determine σ of Rubber tube
19. Determine surface tension of water by Jaeger's method
20. Study the air damping by compound pendulum
21. Variation of magnetic field by tangent galvanometer

Section : B

1. Characteristics of a ballistic galvanometer.
2. I-V Charateristic of a P-N junction diode.
3. I-V Charateristic of a Zener diode.
4. Setting up and using an electroscope or electrometer.
5. Use of a vibration magnetometer to study a field.
6. Study B field due to a current.
7. Measurement of low resistance by Carey-Foster bridge or otherwise.
8. Measurement of inductance using impedance at different frequencies.

9. Measurement of capacitance using impedance at different frequencies.
10. Study of decay of currents in LR and RC circuits.
11. Response curve for LCR circuit and resonance frequency and quality factor.
12. Sensitivity of a cathode-ray oscilloscope.
13. Characteristics of a choke.
14. Measurement of inductance.
15. To verify the inverse square law using photocell
16. Study of Lorentz force.
17. Convert a galvanometer to voltmeter of a given range
18. Convert a galvanometer to ammeter of a given range
19. Study the variation of RC circuit with AC source
20. To verify maximum power transfer theorem
21. Study the charging and discharging of a capacitor (variation of RC circuit with DC)
22. Study of discrete and continuous LC transmission lines.

PRACTICAL-SCHEME OF EXAMINATION

Max. Marks: 100

Min.Marks:40

(Time 5 hours)

Note: There will be two experiments of 5 hrs duration. The distribution of marks will be as follows:

Two experiments (one from each groups)

Each of 35 Marks

70 Marks

Viva

20 Marks

Record

10 Marks

Total

100 Marks.

2. MATHEMATICS

Scheme of Examination:

Common paper will be set for both the faculties of Social Sciences and Science. However, the marks obtained by the candidates 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.

1. 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 CoE in consultation with Head, Department of Mathematics in the university.
2. An Internal/external examiner can conduct Practical Examination not more than 100 candidates (20 candidates in one batch)
3. Each candidate has to pass in theory and practical examinations separately

PAPER I (CALCULUS)

UNIT-1: Tangents and Normal's, sub tangent and subnormal (Cartesian and polar forms), Derivative of an arc (Cartesian and polar), pedal equations, curvature.

UNIT-2

Partial differentiation with Euler's theorem and its applications, total derivative, change of variables (polar to Cartesian and vice-versa), concept of tangent plane and normal to a surface, maxima and minima of two variables including method of undetermined multipliers

UNIT-3

Asymptotes, multiple points, curve tracing (Cartesian, parametric and polar). Envelopes and Evolutes.

UNIT-4

Reduction formulae, double and triple integrals, change of order of integration double integrals, change of variables in multiple integration

UNIT-5

Quadrature, rectification, volume and surface of solids formed by revolution

Textbooks and References:

1. Advanced Engineering Mathematics: E. Kreyszig, 9th ed., Wiley Eastern, 2011.
2. Engineering Mathematics: Ram Babu, Pearson, India, 2010.
3. Calculus Vol. 1 and 2: T.M. Apostol (2007) Wiley
4. Calculus: M. Spivak (2006) Cambridge
5. Calculus: J. Stewart (2012) Cengage Learning
6. Calculus and Analytic Geometry: G.B. Thomas, R. Finney (1995) Addison- Wesley

PAPER II (VECTOR CALCULUS AND GEOMETRY)

UNIT-1

Continuity and differentiability of vector functions, unit tangent vector, gradient, directional derivatives, tangent plane and normal line. Divergence and curl of a vector field

UNIT-2

Integration of vectors, Stok's, Green's and Gauss theorem (statement and verification only), application to area

UNIT-3

General equation of second degree, tracing of conics, polar equation a conic, sphere, cone and cylinder.

Textbooks and References:

1. Calculus Vol. 2: T.M. Apostol (2007) Wiley
2. Calculus: J. Stewart (2012) Cengage Learning
3. Calculus and Analytic Geometry: G.B. Thomas, R. Finney (1995) Addison- Wesley

PAPER III (MATRIX AND LINEAR ALGEBRA)

UNIT-I: Matrices, system of linear equations, Gauss elimination method, Elementary matrices, invertible matrices Gauss-Jordan method for finding inverse of a matrix, determinants, basic properties of determinants. Cofactor expansion, determinant method for finding inverse of a matrix, crammer's rule, Vector space, subspace, Examples

UNIT-2

Linear span, linear independence and dependence, Examples Basis, dimension, extension of a basis of a subspace, intersection and sum of two subspaces, examples, Linear transformation, kernel and range of a linear map, rank-nullity theorem. Rank of a matrix, row and column spaces, solvability of system of linear equations, and some applications. Inner product on \mathbb{R} , Cauchy-Schwartz inequality, Eigen values, Eigen vectors.

Textbooks and References:

1. Linear Algebra: K. Hoffman and R. Kunze (2009) Prentice-Hall
2. Finite Dimensional Vector Spaces: P. Halmos. (2012) Martino Fine Books
3. Introduction to Linear Algebra: G. Strang (2009) Wellesley Cambridge Press
4. Linear Algebra done right: S. Axler (2014) Springer
5. Linear Algebra with applications: Bretscher (2012) Pearson

PAPER IV (SPECIAL FUNCTION)

UNIT 1

Hyper Geometric confluence, hyper geometric functions, hermite and lagurre Polynomial, their generating functions and general integral properties.

UNIT 2

Legendres Polynomial Legendre's Functions Bessel's Functions Recurrence relations, Orthogonal Properties.

Text books and References:

1. Rainville E,D. : Special Functions
2. Sneddon I.N. : The use of Integral Transform, Mc- Graw Hill Co.1966
3. Slater L.J. : Confluent Hypergeometric functions,
4. Gokhroo et.al. : Special Function, Navkar Pulication Ajmer
5. L.S. Slater : Generalized Hypergeometric Functions, Camb. University Press, 1966

3. ZOOLOGY

Scheme of Examination:

Paper	Name of Paper
Paper-1	Animal Diversity-1
Paper-2	Animal Diversity-1
Paper-3	Biochemistry
Paper-4	Cell Biology
Paper-5	Molecular Biology
Paper-6	Genetics and Biostatistics
Practical's	(2 Days hrs.)

Section A Consists 10 question. Each question carries 1 Marks, Attempt all Question.

Section B Consists of 10 question. Each question carries 3 Marks, Attempt 5 Question.

Section C Consists of 5 question. Each question carries 5 Marks, Attempt 3 out of 5 Question.

Seminars, posters, m models, educational tour report, practical's record etc. will Carry internal marking which will be added in the practical.

PAPER-I: ANIMAL DIVERSITY-I (NON CHORDATES)

Unit-I: Principles of classification: Salient feature and classification up to order in non chordates (Protozoa to Ascheminthes).

2. Protozoa Type Study- Entameba, Paramecium, Plasmodium, Trypanosoma and leishmania.

Unit- II Origin of Metazoa: Metamerism, Organization of coelom and canal system. Segmentation, germ layer., Porifera: (I) Type study- Sycon; Types and evolution of canal system. (II) Development of Syoon.

Unit-III Coelenterata: (I) Type study- Obelia and Aurelia: Polymorphism in Hydrozoa. (II) Metagenesis. Ctemoprora: Type study Affinities of Ctenophora.

Unit- IV Platyhelminthes: Type study: fesciola hepatica and Tenia solium: Parasitic adaptations. Aschehlminthes: Type study: Ascaris, parasitic adaptations.

Unit-V Economic importance of Protozoa and parasitism. Economic importance of poriferat corals and coral reet types. Formation and distributation with reference. It India and their conservation polymorphism in siphonophores. Helminths and human diseases.

Paper-II Animal diversity-II (Non Chordates)

Unit-I

Salient features and classification up to orders (Annelida to Hemichordates). Annelida: Type study- Pheretima, Leech, Metamerism in Annelida.

Unit-II Arthropoda: Type study - Prawn; Crustacean larval forms; Mouth parts and vision of Arthropods; Social insects (Termite and honey bee).

Unit-III Mollusca: Type study - Pila and Unio; Torsion and distortion in Gastropodas, Mollusca larvae

Unit-IV Echinoderms: Type study - Asterias; Larval forms of Echinodermata; Affinities of Echinodermata

Unit-V Applied aspects of (i) Vermiculture (ii) Sericulture and Ericulture. (iii) Lac culture. (iv) Apiculture Economic importance of Arthropods; Metamorphosis in insects; Integrated pest management, Economic importance of Mollusca; Pearl culture.

Paper-III Biochemistry

Unit-I: Basic chemical concepts, Bonds and functional group, Carbohydrates Classification, structure and clinical significance, Lipids: Classification, structure and clinical significance.

Unit-II Vitamins Types (water and fat soluble), structure, function and clinical significance. Proteins: Classification and structural properties.

Unit-III Enzymes: Nature of enzymes and classification of co-enzymes, co-factors, inhibition (competitive, UN competitive and non-competitive).

Unit-IV Regulation of metabolism: (i) Carbohydrates: Oxidation of glucose through glycolysis, Krebs cycle and oxidative Phosphorylation glycogenesis, glycogenolysis and gluconeogenesis. (ii) Proteins: Essential and non essential amino acids, Transformation of amino acid deamination, transamination, Decarboxylation, Fate of ammonia, Synthesis of urea (Ornithine cycle).

Unit-V (iii) Lipids: B-oxidative pathway of fatty acids, brief account of biosynthesis triglycerides, cholesterol and its metabolism. (iv) Inborn errors of metabolism [(Galactosemia, Glycogen storage disease (type I- IV Hurler syndrome, Phenylketonuria, Alkaptonuria, Maple syrup ur Lysosomal storage disease (Fabry disease, Gauchers disease, Nieman Pic disease, Lesch-Nyhan syndrome).

PAPER-IV CELL BIOLOGY

Unit-I Microscopy: General principle of compound microscope, fluorescent and electron microscope. Principles and uses of instruments: pH meter, colorimeter, spectrophotometer and centrifuge.

Unit-II Separation of cellular organelles through centrifugation and their characterization Structure of prokaryotic and eukaryotic cells; Diversity of cell size and shape. Plasma membrane: Danielli-Davaon model. Unit membrane model Overton membrane model and Fluid mosaic model of Singer and Nicholson; Structure and functions of plasma membrane.

Unit-III Structure and function of cell organelles: Golgi complex, endoplasmic reticulum, ribosomes, (prokaryotes and eukaryotes), lysosome, peroxisomes and mitochondria. Nucleus and nuclear envelope Ultrastructure of interphase nucleus and nuclear envelope.

Unit-IV Chromosome structure: Morphology, chromonema, chromatids, primary and Secondary constrictions and telomeres. Chromosome types and function Polytene and Lampbrush chromosomes, Cell junctions: Tight junctions, desmosomes. Transportation: Osmosis. Diffusion facilitated and mediated active transport (Na^+K^+ ATPase pump, Ca^+ ATPase pump) and ionic basis of membrane excitation.

Unit-V Microtubular organelles: Structure and function of cilia, flagella and centrioles. Eukaryotic cell cycle: Mitotic and meiotic cell division and their significance.

PAPER -V MOLECULAR BIOLOGY

Unit-I Chromosome remodeling: Nucleosome concept, solenoid and scaffold formation heterochromatin and euchromatin. RNA: Structure and types (mRNA, rRNA and tRNA). Replication mechanism in prokaryotes.

Unit-II Transcription in prokaryotes. Translation in E coli.

Unit-III DNA, Replication in eukaryotes polymorphism. Genetic code.

Unit-IV Transcription in eukaryotes, Translation and post-translational modification, in eukaryotes gene expression: Operon concept lac operon.

Unit- DNA repairs: Direct, reversal. base-excision repair, alkylation, nucleotide excision repair.

Transposons: LTR, reverse transcription of retroviral genomic. RNA to DNA. Gene transfer

(Conjugation, transformation and transduction) and gene therapy.

PAPER – IV: GENETICS AND BIOSTATISTICS

Unit- I Mendelian inheritance ; Deviation from Mendelian inheritance. Chromosomal theory of inheritance., Multiple alleles, gene interaction, epistasis, lethality and pleiotropism.

Unit- II: Linkage, crossing over and linkage maps., Sex chromosome system and sex linkage.6. Non chromosomal inheritance.

Unit- III: Sex determination and dosage compensation in Drosophila and mammals.8. Mutation:

Types and molecular basis: Variation in chromosomal number.9. Gene concept: Recon, muton and cistron.

Unit- IV: Human genetics; somatic cell genetics, meiotic consequences, single gene disorder. (Albinism, Tay Sachs disease, Familial hypercholesterolemia. Sickle cell anemia Haemophilia, Thalassaemia, Fragile X- syndrome & Duchenne muscular dystrophy genetic disorders (Down's syndrome, Patau's syndrome, Turner's syndrome Klinefelter's syndrome, Cri-du-chat syndrome, Philadelphia syndrome Hermaphroditism and pseudohermaphroditism).

11. Eugenics, eugenics and eugenics.

Unit- V Introduction, scope and application of biostatistics. Understanding the concept of descriptive and inferential statistics. Frequency distribution. Diagrammatic and graphical presentation of data (bar diagrams, histograms, frequency Polygons & pie charts). Measures of central tendency: Mean, median and mode (direct, short-cut & standard deviation methods) and their merits & demerits.

SYLLABUS: B.SC. ZOOLOGY (HONS.) PART-I

8 hrs./ week

Max. Marks- 100

Practical's

1. Microscopic techniques

1. Organization and working of optical microscopes: (Dissecting and compound microscopes.
2. General methods of microscopic permanent preparations; Narcotization: fixing and preservation, washing, staining and destaining, dehydration, clearing and decolourization & mounting.
3. General idea of composition, preparation and use of;
 - (a) Fixatives: Formalin and Bouin's fluid.
 - (b) Stains: Borax carmine, Aceto- carmine, Aceto- orcein, haematoxylin Wosin.

II. Collection and culture methods

1. Collection and culture of Euglena, Daphnia, Cyclops etc.
2. Culture of Paramecium in the Laboratory and study of its structure, life process.. and behavior.

III. Museum specimen

1. Porifera: Sycon, Leucosolenia, Euplectella and Spongilla.
2. Coelenterate: Obelia (Polyp & medusa form), Millepora Physalia, por.....Velella, Aurelia, Alcyonium, Tubipora, Gorgonia, Sea .. Fangia, Favea and Astraea.

3. Ctenophora: Pleurobranchia/ Cosloplana and Ctenophora/ Beroe (anyone).
4. Platyhelminthes: Ascaris.
5. Aschelminthes: Fasciola Taenia and planarala.
6. Annelida: Nerets, Heteronereis, Chostopterus, Arnioola. Glossiphonia, Pontobdella Htrudinarla and Poiygordius.
7. Onychophora: Peripatus.
8. arthropoda: Limulus Spider, Scorpion, Centipede, Millepede, Lapas, Balanus, Squilla, Eupagarus, Crab, Manils. Apis, Locust. Silkworm and Beetia.
9. Mollusca: Chiton, Deniallum, Aplysta, Cypresa, Myttlus, Pearl oyster, Loligo and Nautilus.
10. Echinodermata: Aniedon, Holothurla, Cucumaria, Echinus, Pentaceros and ophiothrix.
11. Hemichordata: balanoglosaus.

IV. Microscopic slides

1. Protozoa: Euglena, Trypanosoma, Entamoeba, Leishmania, giardia, Elphidium, Foraminiferous shell. Monocystis, Pflasmodium, Paramecium, Paramecium (binary fission & conjugation). Opalina Nyctotherus, Batantidium and fornicella.
2. Porifera: L.S. & T.S. of Sycon, spongin spicules, spongin fibers and gemmules.
3. Coelentrata: Obelia, Hydra and Obelia medusa.
4. Platyhelminthes: T.S. of Fasciola, Miracidium, Sporocyst, Redia and Cercaria larvae of Fasciola. Taenia-Scolex. T.S. of Taenia through mature proglot.... Cysticercus larva.
5. Annelida: T.S. of body of Nereis Heteronereis- parapodium.
6. Arthropoda: Pediculus, Bedbug, Ternite (various types). Culex Daph.... Crustacean larvae, identification of vectors of disease of diseases- Anopheles.... Culex and Aedes.
7. Mollusca : V.S. Shell, W.M. of gill of Pila, T.S. gill of Umo, Glochidium.

V. Anatomy: Study of the following with Dissection.

1. Pheretima: External features, general viscera, alimentary canal, nervous system and reproductive system.
2. Periplanta: External features, appendages, mouth parts, alimentary canal..... Nervous system and reproductive system.
3. Paleomon/ Squilla: External features, appendages, alimentary canal and nervous system.
4. Pila: External features, pallial organs and nervous system.

VI. Permanent Preparation

Amoeba, Paramecium, Euglena, Foraminifera shells, Sponge spicules, Sponge fibres, Gemmules, Hydra. Obelia colony, Parapodium of Nerets and Heteronereis, salivary gland, mouth parts and trachea of periplanta, Nerve ring, septal nephridia and ovary of Pheretima, Osphradium, gill lamella and radula of Pila, Statocysts and hastate plate of Paleomon / Squilla, whole mount of mosquito larva.

VII. Exercises on Biochemistry

1. Detection of carbohydrates. Proteins and lipids in the given sample.
2. Identification of mono: di- and lipids in the given sample.
3. Quantitative estimation: Standard curve of total cholesterol, total protein and glycolgen.
4. Paper chromatography: radial chromatography and ascending/ descending chromatography (Amino acids).

VIII. Exercises in Cell Biology

1. Squash preparation for the study of mitosis in onion root tip.
2. Squash preparation for the study of meiosis in Grasshopper Periplanta testis.
3. Study of giant chromosomes in salivary glands of chromosomes larva.
4. Study of mitochondria using vital stain (Janus Green B).
5. Permanent slides of mitosis and meiosis (all stages).

IX. Exercises in Genetics

1. Study of Drosophila Culture its life cycle.
2. Identification of male & female Drosophila.

3. Identification of wild and mutant (Yellow body, Eboay body. Yestigial wing White eyes etc.) Drosophila.
4. Permanent preparation of W.M. of Drosophila.
5. Permanent preparation of sex comb of Drosophila.
6. Study of Barr Body from Buccal smear.
7. Identification of blood groups in men (A,B,AB,O and Rh)
8. Numerical problems based on Mendel's Laws.
9. Study of chromosomal aberrations Klinefelter's syndrome, Down's syndrome Turner's Syndrome.

X. Exercises in Biostatistics

1. Construction of frequency tables, bar diagrams, histograms, frequency polyga.... And Pie charts.
2. Exercises on Mean, median and mode (Direct, short- cut and step deviate..... methods).
3. Exercises on standard deviation and standard error.

ZOOLOGY (HONS.)

Scheme of practical examination and distribution of marks 8 Hrs.(2 days, 4hrs/day)

Min. marks: 20

Ist da

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

Min. marks: 20

Max. marks: 50

Register

08
04
07
16
05
05
05

Max. marks: 50

IInd day

1. Exercise in Cell Biology
2. Exercise in Genetics
3. Exercise in Biostatistics
4. Identification and Comments on spots(1 to 8)
5. Viva voce
6. Class Record
7. Seminar Project Report/ Collection

07
06
06
16
05
05
05

Note:

1. With reference to anatomy, and prescribed types, candidates must be well versed in the study of various systems with the help of charts/models/CD ROMs/ multimedia computer based simulations including computer assisted learning (CAL) and other software's.
2. With reference to whole mounts and museum specimens in case of the animal type may be substituted with diagrams/Photographs/ models etc.
3. Students will keep record of all the work done in the practical records.
4. Its should be ensured that animals used in the practical exercise are not covered under the wild life act 1972 and amendments made snbeequently.
5. The details methodology may be written where ever is necessary.

Recommended Books:

1. Ahaan J and Sinha SP: A Hand book on Economic Zoology, 9th edition S.Chand & Sons Ltd. 1981.
2. Bally NTJ: Statistical Methods in Biology, English University Press, 1984.
3. Barrington EJW: Invertebrate Structure and function. 2nd edition Jhone Wiley & Sons Inc. 1978.
4. Brusca RG and Bruscs GJ: Invertebrates 2nd edition Sinsuer/Fanlma Books,2003.

5. Cooper GM and Hausman RE: The Cell, Molecular Approach. 4th edition ASM Press Washington, DC,2007.
6. Cooper GM and hausman RE: The Cell Molecular Approach 6th edition ASM Press Washington DC/ Sinauer/Panama Books,2013/
7. De Robertis EDP and De Robertis Jr. EMF: Cell and Molecular Biology, 8th edition Lippineet Willams & Wilkins, 2006.
8. Grander E.L. SImmons MJ and Snustad DP: Principles of Genetics 8th edition John Wiley & Sons Inc. 2006.
9. Gupta Pk. Genetics: Classical to Modern, Rastogi Publications,2007.
10. Gurumani N: An Introduction to Biostatistics MJP Publishers,2011.
11. Jordan EL and Verma PS: Invertebrate Zoology S. Chand & Company Ltd. 2012.
12. Karp G: Cell & Molecular Biology: Concepts and Experiments. 7th edition John Wiley & Sons Inc, 2013.
13. Kotpal RL: Modern Text Book of Zoology Invertebrates Rastogi Publications.
14. Lal SS: Practical Zoology invertebrate. 11th revised edition Rastogi Publicatons, 2014.
15. Lehninger AL: Biochemistry. 2nd edition Kalyani Publishers,1991.
16. Lodish H. Berk A.Kaiser CA. Kriegr M. Scon MP, Bretscher A. Ploegh H.Matsudaira P: Molecular Cell Biology. 6th W.H. Freeman and Company. New York ,2008.
17. Lodish H. Berk A. Matsudaira P. Kaiser CA. Krieger M, Scott MP. Zipursky SL. Darnell J: Molecular cell Biology. 5th edition W.H. Freeman and Company, New York, 2004.
18. Lodish H. Berk A. Kaiser CA. Krieger M. Bertscher A. Ploegh H. Amon A. Scott M.P. Molecular Cell Biology. 7th edition Mac Millian High Education (International edition) England, 2013.
19. Lodish H. Berk A. Zipursky SL. Matsudaira P, Baltimore D, Darnell J: Molecular Cell Biology. 4th edition WH. Freeman & Company, New York, 2000.
20. Mahajan BK: Methods in Bioostatistics. 7th edition Jaypee Publishers. 2010.
21. Morgen DD: The Cell Cycle: Principles of Control. Sinauer/ Panama Books, 2007.
22. Nelson DL and Cox MM: Lehninger Principles of Biochemistry. 5th edition W.H. Freeman, 2008.
23. Nelson DL and Cox MM: Lehninger Principles of Biochemistry. 6th edition W.H. Freeman, 2013.
24. Petsko GA and Ringe D: Protein Structure and Function. Sinauer: Panama Books. 2004.
25. Singh SP and Tomar BS: Cell Biology. 10th edition Rastogi publications. Meerut, New Delhi,2014.
26. Snustad DP and Simmons MJ: Principles of Genetics. 4th edition John Wiley & Sons, Inc, 2005.
27. Sunder Rao PSS and Richard J: Introduction to Biostatistics and Research Methods. PHI. Publisher's 2012.
28. Verma PS: A Manual of Practical Zoology: Invertebrates . S Chand & Co. Ltd. New Delhi, 1971.
29. Verma PS and Jordan EL: Invertebrate Zoology. S Chand & Co. Ltd, New Delhi, 2001.
30. Voet D and Voet JG: Biochemistry. 4th edition, Jhon Wiley & Sons, Inc . 2001.
31. Winchester AM: An Introduction to Genetics. Barners & Noble, Canada, 2002.
32. Winchester AM: Genetics: A Survey of Principles of Heredity. Oxford & IBH Publishing Co. 1967.
33. Winchester Am: Human Genetics Ohio Charles E Merrill Publishing Co. 1971.

4. BOTANY

B.Sc. (Hons.) Part-I

Maximum Marks: 400

Min. Pass

S.No.	Paper	Name of the Paper	Duration
1.	I	Cytology, Genetics and Plant Breeding	3
2.	II	Algae, Fungi and Bryophyta	3
3.	III	Plant Physiology and Biochemistry	3
4.	IV	Ecology and Environmental Science	3
5.	-	Practical	6

Scheme of Examination (Common for all theory papers)

- Each theory paper shall have two parts A & B. Part A will be compulsory having 30 very short answer type questions (with a limit of 20 words) of one mark each with a total of 30 marks.
- Part B of question paper shall be divided into three units. There will be one question from each unit. Question number 2-4 will have internal choice. Each question will carry 10 marks with a total of 30 marks.
- **Note:** It is essential to obtain pass marks i.e. 36%, separately in internal as well as external theory papers and also in practical exam.

PAPER- I: CYTOLOGY, GENETICS AND PLANT BREEDING

UNIT-I

The Cell: Introduction to modern tools and techniques of cell biology (Light and Electron microscopy); History; cell theory; cell size and cell structure of Prokaryotic and Eukaryotic cells.

Cell wall and cell membrane: Origin, ultra structure, chemical constituents and functions of cell wall; models of cell membrane organization; cellular transport and signaling.

Mitochondria and chloroplast: Origin of organelles; organelles structure and biogenesis; organelle membranes and organization of macromolecular complexes; variation in size, shape and number; types of plastids, organelle-nuclear interactions; organelle genome organization.

Structure/function of other sub-cellular structures: Golgi complex; endoplasmic reticulum; ribosome; lysosomes ; microbodies-peroxisomes and glyoxysomes; cytoskeleton.

UNIT-II

Nuclear organization: ultra-structure; nuclear envelope and nuclear pore complex; nuclear matrix and nucleoplasm; DNA and histones; nucleosome and higher level of organization.

Cell division and its regulation: Mitosis and meiosis-historical perspective and significance; various stages of cell division progression; cytokinesis; role of centromere, kinetochore and spindle apparatus; animal and plant cell cycle; mechanisms of cell cycle regulation; apoptosis.

Chromosomal Alterations: Origin, types and effects of duplications, deletions, inversions and translocations; meiosis in structural heterozygotes. Origin, types and effects of auto and allopolyploidy; origin and meiosis in nullisomics, monosomics and trisomics.

Genetic alterations: Spontaneous and induced mutations; mutagens-types and mode of action; transitions, transversions and frame-shift mutations.

UNIT-III

Mendelism: Mendel's experiment and principles of inheritance, back cross and test cross, gene

interaction and modified dihybrid ratios - complementary, supplementary, duplicate and epistatic factors.

Multiple allelism: multiple alleles in *Drosophila* (eye colour) man (blood group).

Linkage and sex determination: coupling and repulsion phases; two and three point test crosses, linkage map; mechanism of sex determination; sex linked, sex limited and sex influenced characters.

Maternal influence on inheritance: shell coiling in snails and Kappa particles in *Paramecium*; cytoplasmic inheritance in yeast (mitochondria) and *Mirabilis jalapa* (plasmid). **Plant breeding:** Introduction, objectives of plant breeding.

Types of plant reproduction: vegetative, sexual and apomixes, their effect on generating and fixing genotypic variation; Green revolution.

Methods of plant improvement: Pureline and mass selection; hybridisation in self and cross pollinated crops; introduction and acclimatisation; hybrid vigour and inbreeding depression.

Suggested laboratory exercises: Cytology

- Study of prokaryotic cells of various organisms.
- Bacteria (*Bacillus*, *Coccus*, *Streptococcus*, *Spirillum*).
- Study of eukaryotic cells of various organisms.
- Comparative study of cell structure in onion cells, *Hydrilla* and *Spirogyra*.
- Study of cyclosis in *Tradescantia* staminal hairs.
- Bacterial staining (Gram's staining).
- Study of plastids (*Cassia*, *Lycopersicum*, *Capsicum*).
- Mitosis- all stages- onion root tip.
- Meiosis -permanent slides.

Genetics and Plant Breeding :

- Study of sex chromosomes.
- Preparation of chromosome maps-Gene mapping with a Three-Point Cross.
- Exercise based on Mendel's Laws.
- Exercise on gene Interaction and modified hybrid ratios.
- Emasculation and hybridisation.

Suggested Readings:

1. Alberts, B., Bray, D.J., Raff, M., Roberts, K. and Wasson, L.D. 2001 Molecular Biology of cell, Garland Publishing Co., Inc., New York.
2. Gupta P.K. 1999. A text book of cell and molecular biology, Rastogi Publication, Meerut.
3. Lodish and Darnell J. 2000. Molecular cell (4th edition). W.H. Freeman & Co. New York, USA.
4. Choudhary, H.K. 1989. Elementary Principles of Plant Breeding. Oxford and IBM Publishing Co., New Delhi.
5. Miglani, G.S. 2000. Advanced Genetics, Narosa Publishing House, New Delhi
6. Russel, P.I. 1998. Genetics. The Benejamins/Cummings Publishikng Co., Inc. U.S.A.
7. Shukla, R.S. and Chandel, P.S. 2000. Cytogenetics, Evolution and Plant Breedings, S. Chind & Co. Ltd., New Delhi.
8. Singh, R.B. 1999. Text Book of Plant Breeding, Kalyani Publishers, Ludhiana.

PAPER- II: ALGAE, FUNGI AND BRYOPHYTA

UNIT-I

Algae: History, occurrence and distribution, general characters, thallus organization and evolutionary tendencies, ultrastructure of algal cell, classification and economic importance; important features and life history of Chlorophyceae-*Volvox* and *Chara*, Xanthophyceae-*Vaucheria* and *Oedogonium*,

Phaeophyceae-*Ectocarpus* and Rhodophyceae-*Polysiphonia*.

UNIT-II

Fungi: History, occurrence and distribution, general characters, ultra-structure of fungal cell, classification and economic importance, nutrition, reproduction, important features and life history of Mastigomycotina-*Pythium*, *Phytophthora*; Zygomycotina- *Mucor*; Ascomycotina-*Saccharomyces*, *Eurotium*, *Chaetomium*, *Peziza*; Basidiomycotina-*Puccinia*, *Agaricus*; Deuteromycotina-*Cercospora*, *Colletotrichum*, General account of Lichens.

UNIT-III

Bryophytes: History, occurrence and distribution, general characters, classification, ecological and economic importance, Study of comparative morphology, anatomy and reproduction among bryophytes, Detailed features of Hepaticopsida-*Riccia* and *Marchantia*. Anthocerotopsida-*Anthoceros*, Bryopsida- *Funaria*.

Suggested laboratory exercises:

Algae External Morphology and Permanent slides of

- *Volvox*: colony, daughter colony, Antheridia, Zygote.
- *Chara*: Sexual organ, Globule and Nucule
- *Oedogonium*: Thallus structure, Sexual Stage, Antheridia and Oogonia.
- *Vaucheria* : Thallus structure, Sexual Stage, Antheridia and Oogonia.
- *Ectocarpus*: Thallus structure, Unilocular and Pleurilocular sporangia.
- *Polysiphonia*: Thallus structure, Cystocarp, Tetrasporophyte.

Fungi

External Morlogy and Permanent slides of

- *Chaetomium* -Sexual reproduction-Ascospores.
- *Peziza*- Senual Reproduction-Apothecia V.S.
- *Puccinia*: Wheat leaf: Uredospore and Teleutospore
- *Agaricus*- Pileus (V.S.)
- *Colletotrichum*-Thallus

Bryophyta

Study of Specimens and external morphology of the following :

- *Riccia* : Thallus structure
- *Marchantia* :Thallus structure, Gemma cup, male and female gametophyte.
- *Anthoceros* :Thallus structure,sporpphyte.
- *Funaria*: Thallus structure, sporophyte.

SUGGESTED BOOKS

1. Bold, H. C., Alexopoulos, C. J. and Delevoryas, T.1987. Morphology of Plants and Fungi (5th Ed.). Harper Collins Publishers, New York.
2. Dube, H.C.1990. Introduction To Fungi. Vikas publishing House Pvt. Ltd., Delhi.
3. Kumar, H.D.1999. Introductory Phycology(2nd Ed.). Affiliated East-West Press, , NY.
4. Puri, P. 1985. Bryophytes. Atmaram and Sons, Delhi, Lucknow.
5. Singh, V., Pandey, P.C. and Jain, D.K. 2013. A text book of Botany (4th edition) Rastogi Publication , Meerut.

PAPER-III PLANT PHYSIOLOGY AND BIOCHEMISTRY

UNIT-I

Plant-water relations: Water transport processes; diffusion and osmosis ; water potential in chemical potential, absorption of water transport through tracheids and xylem transpiration and its significance

factors affecting transpiration ; exchange of gases, role of stomata, mechanism of stomatal movement; antitranspirants, guttation.

Mineral nutrition: criteria of essentiality of element ; macro and micronutrient; role of essential elements; mineral deficiency symptoms and plants disorders; nutrients uptake and transport mechanism; role of cell membranes, ions pumps and carriers; ion antagonism and toxicity.

Transportation of organic substances: transport of photosynthetic; source-sink relationship the mechanism of translocation in the phloem assimilate *partitioning*.

UNIT-II

Photosynthesis: Structure of photosynthetic apparatus; photosynthetic pigments; electron transport pathways in chloroplast membranes; photophosphorylation; Calvin cycle; C4 carbon cycle ; Crassulacean acid metabolism ; photorespiration.

Respiration: Glycolysis; TCA cycle and its regulation; electron transport in mitochondria; oxidative phosphorylation, pentose phosphate pathway.

Nitrogen metabolism: Biological nitrogen fixation; reduction of N₂ to ammonia, nif genes; regulation of nitrate reductase and nitrogenase; nitrate and ammonium assimilation.

UNIT-III

Growth and development: Phases of growth ; Seed dormancy and seed germination; concept of photoperiodism; physiology of flowering; the florigen concept and role of hormones; vernalization; Senescence and fruit ripening; importance of respiratory climacteric; discovery, physiological role and mechanism of action of the phytohormones- auxins, cytokinin, gibberellins, abscisic acid, Signal transduction basic concept; plant movement-tropic and nastic; Biological clock.

Secondary metabolites: Introduction of secondary metabolites (alkaloids, flavonoids and steroids) and their importance.

Suggested laboratory exercises:

Physiology and Biochemistry

- **Root Pressure**-To demonstrate root pressure.
- **Transpiration**-To demonstrate rate of transpiration by use of potometers.
- **Photosynthesis** - Photosynthesis by inverted funnel method, Moll's experiment.
- **Respiration**- To demonstrate anaerobic and aerobic respiration.
- **Respiration**-R.Q. by Ganong's respirometer.
- **Growth Measurement**-Measurement of growth using auxanometer.
- **Plasmolysis**- To determine the osmotic potential of vacuolar sap by plasmolytic method.
- **Osmosis**-Demonstration of phenomenon of osmosis by use of potato osmometer.
- **Permeability**-To study the effect of temperature of permeability of plasma membrane.
- **Chloroplast Pigments**-To separate chloroplast pigments by solvent method.
- **Chloroplast Pigments** -To separate chloroplast pigments using paper chromatography.
- **Separation of Amino acids**-To separate amino acids in a mixture by paper chromatography.
- **Enzymes**-To demonstrate the enzyme activity - Catalase, Peroxidase and Amylase and effect of pH and temperature on enzyme activity.
- **Histochemical Test**- Cellulose; Lignin; Starch; Fat; Protein and; Tannin.

Suggested Books

1. Galston, A.W. 1989: Life Processes in Plants, Scientific American Library, Springer-Verlag, New York, USA.
2. Hooykaas, P. J., Hall, M. A. and Libbenga, K. R. (Eds.). (1999). Biochemistry and molecular biology of plant hormones. Elsevier, Amsterdam, The Netherlands.
3. Hopkins, W.G., 1995: Introduction to Plant Physiology, John Wiley & Sons, Inc., New York, USA.
4. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2nd edition). Springer-Verlag New York.

PAPER-IV: ECOLOGY AND ENVIRONMENTAL SCIENCE

UNIT-I

Plants and Environment: Atmosphere (stratosphere, troposphere, mesosphere and thermosphere). Adaptations (Morphological, anatomical and physiological), Hydrophytes, Xerophytes and Halophytes. Light (global radiation, photosynthetically active radiation, Zonation in water body: littoral, limnetic and profundal zones; heliophytes and sciophytes); Temperature (Raunkier's classification of plants: megatherm, mesotherm, microtherm, heikistotherm; themoperiodicity). Soil (soil profile, development-weathering and maturation). Soil texture, soil types, role of pH, organic matter, soil water, soil nutrients. Interactions among organisms (neutralism, amensalism, allelopathy), competition, predation, parasitism, proto cooperation, mutualism.

Ecosystems: Concept, Structure and Function of Ecosystem; Energy flow models and principles; trophic levels; Food chains and Food webs; Productivity; Ecological Pyramids; Ecological efficiency; Biogeochemical Cycles- C, N and P; Ecosystem Diversity -Aquatic (freshwater) and Terrestrial (Forests).

UNIT-II

Population ecology: Characteristic (Density, Dispersion, Natality, Mortality, Survivorship curves, Age Structure); Diversity and pattern; Population growth, Carrying capacity. Population regulation: -r and k selection. Communities concept of ecological niche, Ecological amplitude, Ecotone and Edge effect; Succession: types, Climax concept, Species diversity (α and β).

Phytogeography: Phytogeography of India, Vegetation of Rajasthan.

UNIT-III

Natural resource management: Renewable and non renewable resource, management and conservation; Endangered conventional and non conventional energy sources; Conservation of Biodiversity. Hot Spots, IUCN categories of threatened species.

Impact of human activities: Pollution of Air, Water, and soil and their prevention and control Environmental Protection Act (EPA) and Global Warming. Environmental Impact Assessment (EIA).

Suggested laboratory exercises:

- Determination of pH of various soil and water samples by pH meter and pH paper.
- Analysis of chlorides and dissolved oxygen in water samples (titration method).
- Determination of bulk density and soil porosity and water holding capacity in soil samples.
- Determination of organic matter in soil samples by Walkley and Black method.
- Determination of species area curve by minimal quadrat size to study the herbaceous vegetation.
- Quantitative analysis of herbaceous vegetation for frequency, density and abundance
- Estimation of biomass of aerial and belowground part of herbaceous plants (fresh and dry weight).
- Study the adaptation of following Hydrophytes :
- Hydrophytes - *Hydrilla* stem, *Typha* leaf and *Nymphaea/Eicchornia* petiole.
- Xerophytes - *Calotropis*, *Capparis* and *Cassurina* stem and *Nerium* leaf.

SUGGESTED BOOKS

1. Odum, E.P. 1983: Basic Ecology, Saunders, Philadelphia.
2. Kormondy, E.J. 1996: Concepts of Ecology, Prantice-Hall of India Pvt. Ltd., New Delhi.
3. Mackenzie, A. et al. 1999: Instant Notes in Ecology, Viva Books Pvt. Ltd., New Delhi.
4. Barbour, M.G., Burk J. H. and Pitts, W.D. 1987. Terrestrial Plant Ecology (2nd ed.). CA: The Benjamin/Cummings Publishing Company, Inc.

B.Sc. (Hons.) PART-II

1. PHYSICS

Scheme of Examination

Name of Paper	Duration (hrs.)
Paper-I Atomic & Molecular Physics	3
Paper-II Analog Electronics	3
Paper-VII Wave & Optics	3
Paper-VIII Mathematical Physics II	3
Practical (Complete 2 Day)	8

PAPER I: ATOMIC & MOLECULAR PHYSICS

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

Unit: I

Introduction of Atomic Physics: Brief review of Bohr and Sommerfeld model of atom. Effect of finite nuclear mass in relation to Rydberg constant. Idea of discrete energy levels and electron spin: Franck – Hertz and Stern –Gerlach experiments Significance of four quantum numbers and concept of atomic orbital's.

Unit: II

Spin Orbit Interaction: Electron angular momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. SpinMagnetic Moment. Stern-Gerlach Experiment. ElectronMagnetic Moment and Magnetic Energy.

Unit: III

Many electron atoms: Pauli's Exclusion Principle. Symmetric and Ant symmetric Wave Functions. Spin orbit coupling. Spectral Notations for Atomic States. Total Angular momentum. Spin-orbit coupling in atoms-L-S and J-J coupling

Unit: IV

Atoms in Electric and Magnetic field: zeeman Effect. Normal Zeeman effect with examples and Anomalous Zeeman effect with examples. Paschen back effect. spin orbit correction. Transition from weak field to strong field. The stark effect.

Unit: V

Rotational, Vibrational and Electronic spectra: Salient features of rotational spectra. Molecule as a rigid rotator. Isotope effect. Salient features of Vibration rotational spectra. Molecule as a harmonic and non harmonic oscillator. Isotope Effect.

Reference Books:

1. Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles: Robert Eisberg and Robert Resnick.
2. Introduction to Atomic Spectra: H.E. White.
3. Atomic & Molecular Spectra: Raj Kumar.
4. Atom, Laser & Spectroscopy: S.N.Thakur and D.K.Rai

PAPER II ANALOG ELECTRONICS

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

Unit: I

Circuit Analysis: - Kirchoff's Laws, Mesh and Node Analysis of dc and ac Circuits, Duality in Networks, Equivalent Star (T) and delta (π) Networks of a Given Network, Star to Delta and Delta to Star Conversion, Wheatstone bridge and its Applications to Wein Bridge and Anderson Bridge.

Modulation and Demodulation:- Types of Modulation, Amplitude Modulation, Modulation Index, Analysis of Amplitude Modulated Wave, Sideband Frequencies in AM Wave, CE Amplitude Modulator, Demodulation of AM Wave using Diode Detector, Idea of Frequency, Phase, and Digital Modulation.

Unit: II

Semiconductor Diodes: – p and n Type Semiconductors. Energy Level Diagram, Conductivity and Mobility, p-n Junction Fabrication (Simple Idea), Barrier Formation in p-n Junction Diode, Current Flow Mechanism in Forward and Reverse Biased Diode (Recombination, Drift and Saturation of Drift Velocity), Barrier Width and Current for Step Junction, p-n junction and its characteristics, Static and Dynamic Resistance, Diode Equivalent Circuit, Ideal Diode, Load Line Analysis of Diodes, Load Line and Q-point.

Unit: III

Two-terminal Devices and their Applications:- (1) Rectifier Diode, Half-wave Rectifiers, Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, Qualitative idea of C, L and π - Filters. (2) Zener Diode and Voltage Regulation. (3) Photo Diode, (4) Tunnel Diode, (5) LED

Bipolar Junction transistors:- n-p-n and p-n-p Transistors, Characteristics of CB, CE and CC Configurations, Current gains α , β and γ and Relations between them, Load Line Analysis of Transistors, DC Load line and Q-point, Physical Mechanism of Current Flow, Active, Cut-off, and Saturation Regions, Transistor in Active Region and Equivalent Circuit.

Unit: IV

Amplifiers: – Transistor Biasing and Stabilization Circuits, Fixed Bias and Voltage Divider Bias, Transistor as 2-port Network, h-parameter Equivalent Circuit, Analysis of a single-stage CE amplifier using Hybrid Model, Input and Output Impedance, Current, Resistance, Voltage and Power Gains.

Coupled Amplifiers: -RC-Coupled Amplifier and its Frequency Response of Voltage Gain. Feedback in Amplifiers, Effects of Positive and Negative Feedback on Input Impedance, Output Impedance and Gain, Stability, Distortion and Noise.

Unit: V

Sinusoidal Oscillators: - Barkhausen's Criterion for Self-sustained Oscillations. RC Phase Shift Oscillator, Determination of Frequency. Hartley Oscillator, Colpitts Oscillator. Non-Sinusoidal Oscillators – A stable and Monostable Multivibrator.

Three-terminal Devices (UJT and FETs):- (1) UJT: Its Characteristics and Equivalent Circuit, Relaxation Oscillator, (2) JFET: Its Characteristics and Equivalent Circuit, Advantages of JFET, MOSFET (Qualitative Discussion only).

Suggested Books:

1. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 8Th Edition, Pearson Education, India, 2004.
2. A. P. Malvino, Electronic Principals, Glencoe, 1993.
3. John Morris, Analog Electronics.
4. Allen Mottershead, Electronic Circuits and Devices, PHI, 1997.
5. Solid state electronic devices By Ben G. Streetman & Sanjay Banerjee, Pearson Prentice Hall, 2006.
6. Basic Electronics & Linear Circuits By N. N. Bhargava, D. C. Kulshreshtha & SC Gupta, Tata McGrawHill, 2006

PAPER III WAVES & OPTICS

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

UNIT- I

GEOMETRICAL OPTICS

Fermat's Principle: Principle of extremum path and application to laws of reflection refraction.

General theory of image formation: Cardinal points of an optical system, general relationships, thick lens and lens combinations, Lagrange equation of magnification, telescopic combinations, telephoto lenses and eyepieces.

UNIT- II

Aberration in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses. Monochromatic aberrations and their reductions; aplanatic points, oil immersion objectives, meniscus lens.

Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece, common types of eyepieces Ramsden & Huygen's eyepiece.

UNIT-III

PHYSICAL OPTICS

Interference: The principle of superpositions, two-slit interference, coherence requirements for the sources, optical path retardations, lateral shift of fringes. Localised fringes Newton's ring; Interference in thin films. Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines, Fabry-Perot interferometer and etalon.

UNIT-IV

Fresnel diffraction : Fresnel half-period, zones plates, straight edge, rectilinear propagation of light.

Fraunhofer diffraction: Diffraction at a slit, half-period zones. Phasor diagram and integral calculus methods, the intensity' distribution, diffraction at a circular aperture and a circular disc, resolution of images, Rayleigh criterion, resolving power of telescope and microscopic systems, outline of phase contrast microscopy.

Diffraction gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings. Resolving power of a grating and comparison with resolving powers of prism and of a Fabry-Perot etalon.

UNIT-V

LASERS

Laser systems : Purity of a spectral line, coherence length and coherence in time, spatial coherence of a source, Einstein's A and B coefficients. Spontaneous and induced emissions, conditions for laser action, population inversion, Ruby and He-Ne laser.

Holography & Nonlinear optics : Hologram, construction and reproduction mathematical analysis, principle of self focusing, principle of fiber optics and types of optical fiber.

Some Text and Reference Books for papers

1. A.K. Ghatak, "Physical Optics"
2. D.P. Khandelwal; "Optics and Atomic Physics" (Himalaya Publishing House, Bombay, 1988).

PAPER IV-MATHEMATICAL PHYSICS-II

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

Unit-1

Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions.

Unit-2

Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity. Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations.

Unit-3

Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions ($J_0(x)$ and $J_1(x)$) and Orthogonality.

Unit-4

Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral). Theory of Errors: Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. Least-squares fit. Error on the slope and intercept of a fitted line.

Unit-5

Partial Differential Equations: Solutions to partial differential equations, using separation of System variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes. Diffusion Equation.

Reference Books:

- Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
- Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
- Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
- Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
- Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, Dover Pub.
- Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press
- Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, Viva Books.

2. MATHEMATICS

PAPER I (ABSTRACT ALGEBRA)

UNIT-1

Set, Relations, functions and binary operations, binary operations in contrast to unary and ternary operations. Group: Definition, examples and simple properties of group and subgroup

UNIT-2

Permutation group, cyclic group, cosets, Lagrange theorem, homomorphism and isomorphism of group, Cayley's theorem

UNIT-3

Normal subgroup and Quotient group, Fundamental theorem of homomorphism group

UNIT-4

Rings: Definition and example. Residue classes ring, Special classes of ring, integral domain, division ring (ring, field) simple properties & ring, sub ring, sub field, ring homomorphism and ring isomorphism.

UNIT-5

Ideal, principal ideal, quotient ring, prime ideal, maximal ideal, Euclidean ring and its properties,

polynomial ring

Textbooks and References:

Topics in Algebra: I.N. Herstein, Wiley Eastern, New Delhi, 2 ed. 1975.

A Course abstract algebra : V.K. Khanna and S.K. Bhambri, Vikas Pub. House, New Delhi, 2rev. ed. 1998.

.Modern algebra: A.R. Vashistha, Krishna Prakashan Mandir, Meerut, rev. ed., 1971.

Algebra: M. Artin (1991) Prentice Hall.

B.S. : Modern Algebra ,199 New Age International Publication

1. Bhattacharya P.B. : Basic Abstract Algebra (iied) Camb Uni. Press India 1997.

PAPER II (REAL ANALYSIS)

UNIT- 1

Real Numbers system: completeness axiom, densities of rational/irrational, properties of real numbers, least upper bound axiom of a function, Basic properties of the limits Continuous functions and classification of discontinuities, properties of continuous functions Boundedness of a continuous function on a closed interval [a,b] existence of a maximum of a continuous function on [a,b], uniform continuity,

UNIT-2

Differentiability, chain rule of differentiability, Mean value theorems and their geometrical interpretations, Darboux's intermediate value theorem for derivatives, Taylor's theorem with various forms of remainders,

UNIT-3

Riemann integral, Integrability of continuous and monotonic functions, The fundamental theorem of integral calculus, Mean value theorems of integral calculus.

UNIT-4

Real sequence, Definition, Theorems on limits of sequences, Bounded and monotonic sequences, Sequential Continuity, Cauchy's convergence criterion, Infinite series of non negative terms, comparison tests, Cauchy's integral test, Ratio tests, Raabe's logarithmic, De Morgan and Bertrand's tests, Alternating series, Leibnit'z theorem, Absolute and conditional convergence.

UNIT-5

Uniform convergence of series of function, Weirestrass M-Test Abel's and Dirichlets' test for uniform convergence. Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests,

Textbooks and References:

Mathematical Analysis: S.C. Malik, New Age International, New Delhi, 2004.

Real Analysis: H.L. Royden, Macmillan, 4 edition 1993.

Principles of Mathematical Analysis: W. Rudin, McGraw Hill, 3 edition 1976.

Shanti Narayan : Real Analysis

G.N. Purohit : Real analysis.

PAPER III (DIFFERENTIAL EQUATION)

UNIT-1

Linear equations and equations reducible to linear form. Exact differential equations, integrating factors, first order and higher degree equations solvable, for x , y , p . Clairaut's form and singular solutions, Geometric. meaning of a differential equation, orthogonal trajectories linear differential equations with constant coefficients, homogeneous linear ordinary differential equations.

UNIT-2

Ordinary simultaneous differential equations, total differential equations. Linear differential equations of second order, transformation of the equation by changing dependent independent variable, method of variation of parameters.

UNIT-3

Series solution of differential equations, power series method, besel, legendze and hypergeometric equations, bersel, legendre and hypergeometric functions and their elementary properties.

UNIT-4

Partial differential equations of the first order, lagranges solution, some special type of equations which can be solved easily by methods other than the general method, Charpit's general method of solution.

UNIT-5

Partial differential equations of second order and higher orders, classification of linear partial differential equations of second order, homogeneous and non- homogeneous equations with constant coefficients partial, differential equations reducible to equations with constant coefficients

Text Books and References:

Differential Equations Vol I:J.L. Bansal and H.S. Dhami, JPH, 2004.

Ordinary and Partial Differential Equations: M.D. Raisinghania and R.S. Theory and problems of differential equations: Frank Ayres, McGraw-Hill Book Company, Singapore, 1 edition 1972.

An Introduction to Ordinary Differential Equations, Dover Books on Mathematics: E. Coddington (1990) Dover

Differential Equations and Dynamical Systems: L. Perko (2010) Springer

Theory of Ordinary Differential Equations: Coddington and Levinson (1987) Tata Mc GrawHill.

PAPER IV (OPERATION RESEARCH)

UNIT I

Linear peograming problem, convex sets, surplus and slack variables the theory of simplex method, simplex algorithm Duality, De-genracy problem , Variation of the simplex method

UNIT II

Dual Simplex method Revised simplex method

UNIT III

Transportation problem and Assignment problem

Text Books and References:

1. Hadley: Linear Programming
2. Gass: Linear Programming
3. Satty: Mathematical Methods of Operation research
4. Vinod Kumar: linear programming problem Krishna publication.

3. ZOOLOGY

Scheme of Examination:

Paper	Name of Paper
Paper 7	Animal diversity-3
Paper 8	Animal diversity -4
Paper 9	Physiology-1
Paper 10	Physiology -2
Paper 11	Immunology-2
Paper 12	Ethology
Practical's	2 day (8 Hrs.)

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

PAPER I: ANIMAL DIVERSITY

Scheme of Examination:

There will be 5 questions in each paper. All questions will be compulsory and carry equal marks. Question number 1. Will comprise 10 very short answer (maximum 25 words) Type questions, each of 1. Marks. Questions should be evenly distributed covering entire syllabus. 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.

Unit –I Origin and general characteristics of chordates. Protochordates- classification up to orders, Interrelations, structural organization of hemichordates, urochordates and cephalochordates and their affinities.

Unit -2 Agnatha classification upto orders. , General study of myxine & petromygon.

Unit-3 Fishes origin and evolution of fishes, classification up to order, type of scales parental care, respiratory organs, lateral line system and migration. , Pisciculture.

Unit-4 Amphibians-Classification upto order origin and evolution of amphibian and parental care, neoteny.

Unit-5 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 II: ANIMAL DIVERSITY

Unit-1: Origin of birds, bird migration and principal of bird flight types of feathers, flight adaptations, perching mechanism. Palaeognathae and neognathae- Distribution and classification, beaks and claws.

Unit-2 Mammals- origin, classification and general characters, dentition, violent adaptation and aquatic adaptations in mammals.

Unit-3 Comparative anatomy of system: Scoliodon, frog, varanus, pigeon and rabbit (Integument, skeletal system).

Unit 4 Comparative anatomy of system: Scoliodon , frog , varanus, pigeon and rabbit(digestive system heart 2 aortic arch).

Unit 5 Comparative anatomy of system: Scoliodon , frog , varanus, pigeon and rabbit (Respiratory system, sensory organs (Eye & Ear) & urinogenital system).

PAPER –III: PHYSIOLOGY

Scheme of Examination:

There will be 5 questions in each paper. All questions will be compulsory and carry equal marks. Question number 1. Will comprise 10 very short answer (maximum 25 words) Type questions, each of 1. Marks. Questions should be evenly distributed covering entire syllabus. 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.

Unit -1

1. Chemical foundations of physiology- solutations, osmotic persure, diffusaion ,pk and Ph buffers.
2. **Osmoregulation:** Osmosis,diffusion, osmoregulation in animals osmotic conformers osmoregulation in hypotonic & hypertonic water animals and osmoregulation in terrestrial animals.
3. **physiology of exertion** : kinds of nitrogenous excretory end –products (ammonotelic, uricotelic and ureotelic), role of liver in the formation of these end products, functional architcture of mammalian tubule and formation of urine : horinonal regulation of water and electrolyte blance.

Unit -2

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.
6. Peripheral circulation: Blood pressure, capillary pressure and regulation.

Unit -3

7. Respiration: Mechanism and control of breathing, concept of partial pressure of gases, Bohr's & Haldane's effect and chloride shift.

Unit -4

8. Sens organ types, structure & working of eye & ear.
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 IV PHYSIOLOGY

Scheme of Examination:

There will be 5 questions in each paper. All questions will be compulsory and carry equal marks. Question number 1. Will comprise 10 very short answer (maximum 25 words) Type questions, each of 1. Marks. Questions should be evenly distributed covering entire syllabus. 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.

Unit -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.

Unit -2 Functional architecture of skeletal muscle, chemical and biophysical events during contraction and relaxation of muscle fibers.

Unit -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.

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

Unit -5 Thermoregulation: physiological process, thermoregulation in cold and hot environments, thermoregulation in poikilotherms and homeotherms. Physiology of high altitude: Acclimatization & adaptations and diseases due to high altitudes.

PAPER V: IMMUNOLOGY

Scheme of Examination:

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

Unit- 1

1. Immunology: Definition, types of immunity & acquired, humoral and cell- mediated.
2. Organs of immune system: Thymus, bone marrow, lymph node, spleen, tonsils, and peyer's patch.

Unit- 2

3. Antigen: Antigenicity of molecules and haptens.
4. Antibody: Structure, properties and function of IgG, IgM, IgD, IgA and IgE.

Unit- 3

5. Antigen- antibody reactions: Precipitation reaction, Agglutination reaction, neutralizing reaction, complement & lytic reaction and phagocytosis.

6 Immunotolerance

Unit - 4

7. Cells of immunity: Macrophages, lymphocytes(B- and T types), T- helper cells, T- killer cells, plasma cells and memory cells.

8. Mechanism of humoral or antibody mediated immunity and cell mediated immunity.

Unit-5

9. MHC: Structure and function of class I, II and III MCH molecules.

10. Autoimmunity: Involvement of CD_4^+ cells, contributing factors in autoimmune disease, Autoimmune disease: Hasimoto's thyroiditis, Type I diabetes, Myasthenia Gravis, rheumatoid arthritis.

PAPER- VI: ETHOLOGY**Scheme of Examination:**

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

Unit -1

1. History and introduction to animal behavior (ethology),brief iden about works of nobel prize winers-konrad Lorenz, kari von Frisch and niko Tinbergen.

2. classical concepts of ethology-fixed action patters, sign stimuli, innate releasing mechanism ,action specific energy;flush toilet model.

Unit 2

3. Structure and functions of human brain, methods of studying – neuroanatomical, neurophysiological and neurochemical techniques.

4. Orientation types of takes and kinesis; navigation in migratory birds.

Unit-3

5. different type of biological clock.

6. feeding in animal kingdom, their functions.

7. pheromones in animal kingdom there functions.

Unit-4

8. Sociobiology-cooperation, reciprocation and altruism; social groups of non human primates.

9. Reproductive strategies among animals.

10. parental care in animals.

Unit-5

11. Difference between learned and unlearned behavior, type 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. Habitual, scientific and common names of 20 wild animals.

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

(A). 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:**

- Heteropeusts, Anabas phiocephalus and clarius. **Any edible fish** : Afferent & efferent branchial arteries, cranial nerves, eye muscles and internal ear.
- (B). **Museeu Specimens:**
 Herdmania, Ascidia, Botryllus, Pyrosoma, Ammocoete larva, etromyzon, myxine, Scoliodon, Sphryma, Torpedo, Chirmaera, Acipenser, Ami, Lepidostenus, labeo, clariu, Anguilla hippocampus, syngathus, Exocoetus, Echeneis. Any flat fish, Protopterus, Leptidesiren Ichthyopis, Protenus. Necturus, Stien Ambystoma, Axolotl larva, salamander, alytes. Rhacophors, Chelone, Testudo, hemidactylus, varanus phynsoma, drama, chameleon. Sphenodon. Mabuya, eryx, hydrophis, viper, naja, naja, Krait, crocodiles, Alligator gavials, Archaepteryx, Peacock, Ostrich, Emu, Ornithorhynchus, Tachyglossus, didelphis, shrew, Kangaroo, bat manis, loris, presbyyis and Macaca.
- (C). **Osteology of frog, Varanus fowl and rabbit (Use of Models/charts/artificial skeleton & bones. Etc.):** Skull, vertebral column, girdles and limbs.
- (D). **Study of permanent microscopic slides:**
 Dololium salpa oikopleura, amphioxus: Whole mount and T.S. passing through different regions of the body, Ammocoete larva: T.S. passing through different of the body, fish scales-cycloid, placcoid: fish : T.S. passing through different regions of the body, Mammalian histology: L.S./T.S. of pituitary T.S. of liver, lung testis ovary, pancreas, thyroid, parathyroid, adrenal, stomach, duodenum and intestine.
- (E). **Permanet Preparation:**
 Herdmania: Pharyngeal wall and spicules. Amphioxus: oral hood, velum and pharyngeal wall. Edible fish scales.
- (F). **Microtomy** : Fixation, processing, Section, cutting & staining (H&E) of organs and morphometric measurements.
- (G). **Physiology**
 (a) Blood : Haemoglobin and haematocrit estimation, WBC and counting, clotting time period and blood pressure.
 (b) blood film: identification of various types of leucocytes.
 (c) study of salivary amylase and catalase (liver) activities.
 (d) Investigate passive diffusion through cell membrane of mammalian red (0.9% NaCl, 0.4% NaCl, 1% NaCl, 2% urea, 3% glycerol and distilled water).
- (H). **Immunology**
 (i) Blood groups: ABO and Rh factor.
 (ii) Widal's test.
 (iii) Slides: Thymus, lymph nodes and spleen.
- (I). **Ethology**
 (a) food preference in tribolium.
 (b) Animal grooming in cockroach.
 (c) Chemical communication among earthworms and ants.
 (d) Reaction of paramecium towards dilute acid drop.
- (J). 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.

Zoology (Hons.)

Scheme of practical examination and distribution of marks.

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

Min. marks: 20

Max. Marks: 50

Ist day

1. Anatomy

09(6+3)

	.Major	
	.Minor	
2.	Permanent preparation/ microtome	05
3.	Exercise in Immunology	05
4.	Identification and Comments on spots(1 to 8)	16
5.	Viva voce	5
6.	Class Record	5
7.	Seminar/ Project Report/Collection	5

Min. marks: 20

Max. Marks: 50

IInd day

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

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 labeling 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 exercise are not covered under the wild life act 1972 and amendments made subsequently.

Recommended books:

1. Alcock J: Animal Behavior: An Evolutionary Approach. Sinauer Associates 2013.
2. Animal Societies and Evolution: Scientific American Publications.
3. Barrington EJW: The Biology Hemichordata and Protochordata. Oliver & Boyd, London 1965.
4. Berril NJ: The Tunicates. The Roy Society, London.
5. Breed MD and Moore J: Animal Behavior. Academic press. 2015.
6. Colbert EH, Morales M, Minkoff EC, Colberts: Evolution of the Vertebrates: A History of the Backboned Animals through Time. 5th edition Wiley Less 2001.
7. Colbret EH, Evolution of the Vertebrates. 2nd edition jhon Wiley & Sons, New York 1969,
8. Costanzo LS: Physiology. 4th edition Saunders Inc. 2009.
9. David R, Burggren Wand French K: Eckert Animal Physiology. 5th edition WH Freeman & Company, Newyork 2001.
10. Fox SI: Human Physiology. 8th edition McGraw Hill Education 2003.
11. Goldsby RA, Kindt TJ and Osborne BA: Kuby Immunology. WH Freeman and Co, New York 2002.
12. Griximek's Encycopedia of Ethology.
13. Hall JE: Guyton and Hall Textbool of Medical Physiology. 12th edition Saunders Publications 2010.
14. Hand book of Ethological Method: Laharen Publications Garland STPM Press.
15. Hill RW, Wyse GA, Anderson M: Animal Physiology. 3rd edition sinauer Associates Inc. USA 2012.
16. Kotpal RL: Modern Text Book of Zoology: Vertebrates. Global Media Publications 2010.
17. MacFarland D: Animal Behavior. Psychobiology, Ethology and Evolution 38 edition Longman

- 1998.
18. Manning A, Dawkins MS: An Introduction to Animal Behavior. Cambridge University Press 2012.
 19. Mathur R: Animal Behavior. Rastogi Publications 2017.
 20. Murphy K: Janeway's Immunology. Garland Science; 8 edition 2011.
 21. Owen J, Punt J, Stranford S: Kuby Immunology. 7 edition WH Freeman & Co. Ltd. 2013.
 22. Prasad SN and Kashyap V: A Textbook of Vertebrate Zoology. 13* edition Wiley Eastern Ltd. 2011.
 23. Sastry KY: Animal Physiology and Biochemistry. 2nd edition. Rastogi Publications 2014-15.
 24. Vander AJ, Sheerman J, Liciano D: Human Physiology: The Mechanics of Body Function. Mc Graw Hill Co., New York 1998.
 25. Verma PS, Tyagi BS, Agarwal VK: Animal Physiology. 6th edition S. Chand & Co., 2004.
 26. Wake MH: Hyman's Comparative Vertebrate Anatomy. 3rd edition University of Chicago Press Ltd. London 1992.
 27. Werlace RA: Animal Behavior. Good Year Publishing Co., Inc.
 28. Young JZ: The Life of Mammals. Oxford University Press 1970.
 29. Young JZ: The life of Vertebrates. 2. edition Oxford University Press. London 1962.

4. BOTANY

B.Sc. (Hons.) Part-II

Distribution of Marks Maximum Marks:400

	Mini.	Pass marks :160
Paper V Molecular Biology	Duration: 3 hrs.	75Marks
Paper VI Pteridophyta, Gymnosperm & Paleobotany	Duration: 3 hrs.	75 Marks
Paper VII Morphology and Anatomy of Angiosperms	Duration: 3 hrs.	75 marks
Paper VIII Microbiology and Plant	Duration: 3 hrs.	75 Marks
Practical (6 hrs.)		100 Marks

PAPER-I: MOLECULAR BIOLOGY

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. Charging of tRNA, aminoacyl tRNA synthetases. Proteins involved in initiation, elongation and termination of polypeptides. Fidelity of translation. Inhibitors of protein synthesis, Regulation of translation.

Gene regulation

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

Suggested laboratory exercises

1. Preparation of culture medium (LB) for *E.coli* (both solid and liquid) and raise culture 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.
6. Study of semiconservative replication of DNA through micrographs/schematic representations.

SUGGESTED BOOKS

1. Karp, G. (2009). Cell and molecular biology: concepts and experiments (6th edition). John Wiley & Sons.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. (8th edition) edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. (7th edition). Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker, T. A. Cold, Bell, S. P., Gann, A., Levine, M. and Losick, R. (2008) Molecular Biology of the Gene: International Edition, (6th Edition). Cold Spring Harbor Laboratory Press, 841 pp.

PAPER-II : PTERIDOPHYTA, GYMNOSPERM AND PALEOBOTANY

UNIT-I

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

Comparative study of morphology, anatomy and reproduction of *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Marsilea*, *Pteris*. Heterospory and seed habit. Detailed account of stelar system.

UNIT-II

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

UNIT-III

Paleobotany: Fossil formation and types of fossils.

Geological time scale: sequence of plants in geological time.

Fossil Pteridophytes: *Rhynia*, *Lepidodendron*, *Calamites*.

Fossil gymnosperms: *Williamsonia*.

Applied aspects of Palaeobotany: Exploration of fossil fuels.

Suggested laboratory exercise.

Pteridophytes

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

Lycopodium : T.S. of Stem *Selaginella* : T.S. of Stem *Equisetum* : T.S. of Stem *Marsilea* : Sporocarp, Petiole. *Pteris*: T.S. of rhizome, T.S. of rachis, V.S. of sporophyll, W.M. of sporangium

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 (T.L.S. & R.L.S.), Needle (V.S.), Male and Female Cone, Mature Ovule

Ephedra- Stem (T.S.), Male and Female Flowers, Mature ovule.

Williamsonia Chart Specimen (Fossil).

Suggested Book

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

PAPER-III: 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.

UNIT-II

Convergence of evolution of tree habit in spermatophyta, Tissues; simple, complex and secretory tissue, tissue system. Shoot and root system: 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:

1. Study of any commonly occurring dicotyledonous plant to understand the body plan and modular type of growth.
2. Life forms exhibited by flowering plants (by visit to a forest or a garden).
3. L.S. of shoot tip to study the organization of meristem and origin of leaf primordia.
4. Monopodial and sympodial types of branching in monocots & dicots.
5. Anatomy of primary and secondary growth in monocots and dicots using hand out sections of sunflower, maize, cucurbita stem and roots.
6. Monocot- Maize (root, stem and leaves).
7. Dicot-*Helianthus*, *Cicer* and *Mangifera* (root, stem and leaves).
8. Anomalous secondary growth in stem: *Salvadora*, *Bignonia*, *Bougainvillea*, *Boerhaavia*, *Nyctanthes*, *Leptadenia*, *Dracena*.

9. Study of diversity in leaf shape and size. Internal structure of leaf- Dorsiventral and isobilateral leaves; study of stomata types.

Suggested Books:

1. Cutter, E.G. 1971. Plant Anatomy: Experiment and Interpretation. Part II. Organ Edward Arnold, London.
2. Esau, K. 1977. Anatomy of Seed Plants, 2nd Edition. John Wiley and Sons, New York.
3. Fahn, A. (1974) Plant Anatomy. Pergmon Press, USA and UK.
4. Mauseth, J.D. (1988) Plant Anatomy. The Benjammin/Cummings Publisher, USA.

PAPER-IV: MICROBIOLOGY AND PLANT PATHOLOGY

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 micro organisms; viruses-properties and classification, characteristics features of host-virus interaction; bacteriophage T4; tobacco mosaic virus (TMV), 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.

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 *barr 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.
- 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 solani*.
- Green Ear Diseases of Bajra- *Sclerospora graminicola*.
- Powdery mildew
- Tikka leaf spot disease of groundnut.
- Red rot of sugarcane-*Colletotrichum fulcatum*.
- Field Study of plants in farmer's field/ Agricultural Stations.

Suggested Books:

1. Bilgrami, K.S. and Dube, H.C. 1984. A textbook of modern plant pathology. Vani Educational Books, a division of Vikas, 344 pages.
2. Biswas, S.B. and Biswas, A. 2000. An introduction to Viruses. Vikas Publishing House Pvt. Ltd. New Delhi.
3. Clifton, A. 1958. Introduction to the Bacteria. McGraw-Hill Book Co., New York.
4. Pelczar, M.J. et. al (2001), Microbiology-Concepts and Applications, International Ed. McGraw Hill Publication, New York.
5. Sharma P.D. 2003. Microbiology and pathology, Rastogi Publication, Meerut.

B.Sc. (Hons.) PART-III

1. PHYSICS

PAPER I: Quantum Mechanics

Duration: 3 hrs.

Marks: 75

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

Unit: I

Origin of Quantum theory : Failure of classical Physics to explain the phenomenon such as black body spectrum. Planck's radiation law. photoelectric effect and Einstein explanation. Compton effect, "deBroglie" hypothesis, evidence for diffraction and interference of particles. Uncertainty principle and its consequences: diffraction at a single slit, particle in a box and its applications (i) Non existence of electron in nucleus, (ii) Ground state energy of H-atom (iii) Ground state energy of harmonic oscillator. Energy-time uncertainty.

Unit: II

Schrodinger equation- Time dependent and time independent form. Physical significance of the wave function & its interpretation. Probability current density, Operators in quantum mechanics, linear and Hermitian operators. Expectation values of dynamical variables, the position, momentum, energy, fundamental postulates of quantum mechanics, eigen function and eigen value, degeneracy. orthogonality of eigen functions' commutation relations. Ehrenfest theorem, concept of group and phase velocities, wave packet.

Unit III

Simple Solutions of Schrodinger equation : Time independent Schrodinger equation and stationary state solution. Boundary and continuity conditions on the wave function, particle in one dimensional box. eigen function and eigenvalues . discrete energy levels, extension of results for three dimensional case and degeneracy of levels. Potential step and rectangular potential barrier. Calculation of reflection and transmission coefficient. Qualitative discussion of the application to alpha decay (tunnel effect), square well potential problem, calculation of transmission coefficient.

Unit IV

Bound State Problems : Particle in one dimensional infinite potential well and finite depth potential well energy value and eigen functions, simple harmonic oscillator (one dimensional) eigen function energy eigen values zero point energy. Schrodinger equation for a spherically symmetric potential. Separation of variables. Orbital angular momentum and its quantisation spherical harmonics, energy levels of H-atom shape of $n=1$, $n=2$ wave functions, comparison with Bohr model and Correspondence principle,

Unit V

General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method; Hermite polynomials; ground state, zero point energy & uncertainty principle.

Reference Books:

- A Text book of Quantum Mechanics, P.M. Mathews and K. Venkatesan, 2nd Ed., 2010, McGraw Hill
- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
- Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press
- Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.

□ Introduction to Quantum Mechanics, D.J. Griffith, 2nd Ed. 2005, Pearson Education

PAPER II: Digital Electronics

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

Unit: II

Operational Amplifiers (Use Black Box approach) :- Basic Characteristics of Op-Amps, Characteristics of an Ideal Op-Amp, Feedback in Amplifiers, Open-loop and Closed-loop Gain, Frequency Response, CMRR, Virtual ground.

Applications of Op-Amps : (1) Inverting and Non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Unity follower, (5) Differentiator, (6) Integrator, (7) Zero Crossing Detector.

Unit: III

Digital Circuits: Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Conversion. AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND AND NOR Gates, Exclusive OR and Exclusive NOR Gates.

Boolean algebra :- De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Fundamental Products, Minterms and Maxterms, Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.

Unit: IV

Data processing circuits: - Basic Idea of Multiplexers, De-multiplexers, Decoders, Encoders, Parity Checkers.

Memories: - Read-only memories (ROM), PROM, EPROM

Sequential Circuits: - RS, D, and JK Flip-Flops. Level Clocked and Edge Triggered Flip-Flops. Pre-set and Clear Operations, Race-around Conditions in JK Flip-Flops. Master-Slave JK FlipFlop (As Building Block of Sequential Circuits)

Unit: V

Shift registers: - Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out, and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

Counters: - Asynchronous and Synchronous Counters, Ring Counters, Decade Counter.

(D/A and A/D conversion): - D/A converter – Resistive network, Accuracy and Resolution.

Suggested Books:

1. Digital principles and applications By Donald P. Leach & Albert Paul Malvino, (Glencoe, 1995).
2. Digital Fundamentals, 3rd Edition by Thomas L. Floyd (Universal Book Stall, India, 1998).
3. Digital Electronics by R.P. Jain,
4. Operational Amplifiers and Linear Integrated Circuits, 4th Edition by Robert F Coughlin and Frederick F Driscoll (P.H.I. 1992)
5. Op-Amps and Linear Integrated Circuits by R. A. Gaya wad(Pearson Education Asia, 2000)

PAPER III: Nuclear and Particle Physics

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weight age will be given to problems and numerical.

Unit- 1

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excited states.

Unit-2

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force. Coulomb scattering (Rutherford scattering), Radioactivity decay

Unit-3

Nuclear Astrophysics: Early universe, primordial nucleosynthesis (particle nuclear interactions), stellar nucleosynthesis, concept of gamow window, heavy element production: r- and s- process path.
Interaction of Nuclear Radiation with matter: Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

Unit-4

Detector for Nuclear Radiations: Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photomultiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector.

Particle Accelerators: Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

Unit-5

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

Reference Books:

- Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
- Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
- Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi

PAPER IV: Solid State Physics

Note: Question paper will have Five units (each question will have an internal choice) Student are required to attempt all the five questions. 40% Weightage will be given to problems and numerical.

Unit-1

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor. Elementary band theory: Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator.

Unit-2

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T₃ law. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient.

Unit-3

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia- and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's

law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

Unit-4

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeier relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons,

Unit-5

Ferroelectric Properties of Materials: Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field.

Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation)

Reference Books:

• Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.

• Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India

• Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill

• Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning

• Solid-state Physics, H. Ibach and H. Luth, 2009, Springer

• Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India

• Solid State Physics, M.A. Wahab Narosa **Ferroelectric Properties of Materials:** Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field.

Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation)

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• Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning

• Solid-state Physics, H. Ibach and H. Luth, 2009, Springer

• Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India

• Solid State Physics, M.A. Wahab Narosa

2. MATHEMATICS

PAPER-I COMPLEX ANALYSIS

UNIT- I

Complex numbers, function of a complex variable, limits, Cauchy Reimann equations (Cartesian & polar forms), continuity, differentiability of a function. Analytic functions,

UNIT- II

Harmonic functions, Construction of an analytic function Conformal mapping, Bilinear transformation, and its properties,

UNIT-III

Complex integration, Complex line integrals, Cauchy's integral theorem, Indefinite integral, Fundamental

theorem of Integral calculus, Derivative of an analytic function, Liouville's theorem, Poisson's integral formula.

UNIT-IV

Morera's theorem, Taylor's & Laurents series, Maximum, modulus principle, Singularities, Zeros of an analytic function,

UNIT-V

Residue theorem, residue at a pole, residue at infinity computation of residue, Rouché's theorem, fundamental theorem of algebra,

Textbooks and References:

1. Functions of a Complex Variable: J.N. Sharma, Krishna Prakashan, Meerut, 1998.
2. *Function Theory of One Complex Variable: R.E. Greene and S.G.*
3. Complex Analysis: L. Ahlfors (1979) McGraw Hill.
4. Functions of One Complex Variable I: J.B. Conway (1978) GTM Springer
5. Complex Analysis (Princeton Lectures in Analysis): E.M. Stein, R. Shakarchi (2003) Princeton University Press
6. Complex Analysis: G. N. Purohit and S. P. Goyal, JPH, 2005.
7. Complex Analysis A. R. Vasishtha, Krishna Prakashan Media (P) Ltd., Meeruth, edition, 2019.
8. Real and Complex Analysis: Walter Rudin, Mc-Graw Hill, New Delhi, 2006.

PAPER-II Numerical Analysis

UNIT-1 Differences operators, Relation between difference and derivatives, Differences of polynomials, Newton's formula for forward and backward interpolation, Divided differences and simple differences, Newton's general interpolation formula, Lagrange's interpolation formula,

UNIT-2 Gauss central difference formula, Stirling and Bessel interpolation formula Numerical differentiation,

UNIT-3 Numerical integration- Trapezoidal rules and Simpson's Weddle's rules

UNIT-4 Root finding for Transcendental and Algebraic equations, Bisection method, Regula-Falsi method, Newton Raphson's method, Runge kutta method.

Textbooks and References:

1. An Introductory Methods in Numerical Analysis: S.S. Sastri, P.H.I, New Delhi, 4 edition 2005.
2. Numerical Analysis: J.L. Bansal, J.P.N. Ojha, JPH, Jaipur, 1991.
3. An introduction to Numerical Analysis: Kendall E. Atkinson, John Wiley, New York, 22001.
4. Computer based Numerical methods and statistical techniques: P.K. De CBS publication New Delhi 1 edition 2006.

PAPER-III Mechanics

UNIT-1

Moment and product of Inertia, Moment of inertia of a body about line through the origin, Momental ellipsoid, rotation of co-ordinate axes and principal moments. K.E. of rigid body rotating about a Fixed points, angular momentum of a rigid body, Eulerian angle, angular velocity, K.E. and angular momentum in terms of Eulerian angle, Euler's equation of motion for a rigid body

UNIT-2

Conservation of Momentum and Energy. Initial Motions, Classification of dynamical system Generalized coordinate system Lagrange's equations for a simple using D'Alembert principle

UNIT-3

Lagrange's equation of first kind, Lagrange's equations of second kind. Hamilton's variables. Hamilton canonical equations, Hamilton Jacobi Equations, Canonical transformation and its properties, Lagrange Brackets,

Text Book and References:

1. Vectorial Mechanics by E.A. Milne; Methuen & Co. Ltd. London 1965
2. Dynamics (Part II) by A.S. Ramsey; CBS Publishers & Distributors, Delhi 1985
3. Classical Mechanics by H. Goldstein; Arosa Publishing House, New Delhi 1990
4. Generalized Motion of rigid body by N. Kumar Narosa Publishing House, New Delhi 2004
5. Classical Mechanics by K. Sanskara Rao; PHI Learning Private Ltd. New Delhi 2009.

PAPER -IV Mathematical Method and Number Theory

UNIT-1

Laplace Transform: Definition and properties, Rules of manipulation: Laplace Transform of derivatives, Inverse Transform, Complex in version formula, Convolution theorem,

UNIT-2

Use of Laplace Transform to solve differential equation with constant coefficient, Variable coefficients, Simultaneous equations and simple Partial differential equation, Fourier series,

UNIT-3

Divisibility – Division Algorithm, G.C.D. the Euclidean algorithm, L.C.M., Prime Infinitude of primes, Fundamental theorem of Arithmetic, Fibonacci sequence,

UNIT-4

Congruence- Linear congruence, Fermat, Little and Wilson's theorems Fermat's Last theorem, Euler's Factorization,

UNIT-5

Number theoretic functions, the Möbius functions Greatest integer functions Euler phi-functions and its properties quadratic residue

Text Book and References:

1. Sneddon I.N. : The use of Integral Transform, Mc-Graw Hill Co., 1966
2. Spiegel M.R. : Theory and Problem of Laplace Transform, McGraw Hill Co.
3. Engineering mathematics, T Veerajan, TMH
4. Mathematical Methods, Dutta D. New age
5. Basic of Engineering mathematics Voll-II S.Chand, New delhi 2006
6. S. Telang and M. Nadkarni, Number theory, Tata Mc Graw hill, 2001
7. I.Niven and H. Zuckerman, An Introduction to the number theory, Wiley Eastern University Edition, New delhi 1985
8. Neville Robbins, Beginning Number theory 2nd edition, Narosa publishing house Pvt. Ltd., Delhi 2007.

3. ZOOLOGY

Paper I: Ecology

Unit - I

1. Aim and scope of Ecology.
2. Concepts of limiting factors.
3. Ecosystem: Abiotic and biotic factors.
4. Competition in nature-Intraspecific and interspecific, predation and parasitism-concept, evolution of prey-predator strategies, evolution of parasitism, host parasite relationship: Commensalism and mutualism.
5. Ecosystem: Production, consumption and composition in an ecosystem: Concepts of food chain food web, trophic structure, ecological pyramids, Biogeochemical cycles: O₂ CO₂ H₂O, N & P and role of microbes.

Unit II Ecosystem homeostasis, functional aspects, productivity concepts and its determination, ecotone, edge effect and niche. Population ecology: population characteristics, growth and its analysis, regulation of densities, density and methods of its measurement, natality, mortality, age ratio and distribution,

pyramids, fluctuation, biotic potential, dispersal, growth forms, population interactions & propagation and brief idea of demography.

Unit – III Community ecology: Characteristics of natural communities, structure, composition and stratification. Ecological succession: Types and patterns, concept of climax, details of xerosere and hydrosere successions. Habitat ecology: Fresh water, marine, terrestrial and estuarine water.

Unit – IV: Major biomes of the world: Desert, grassland, tundra, temperate, tropical moist forest and seasonal forest. Ecology and human future: Growth rate, role of human kind in modifying natural communities.

Paper-XIV: Environmental Biology

Unit – I Environmental and its concept global environment, hydrosphere, lithosphere, atmosphere and biosphere. Natural resources: Present status and future needs. Management of natural resources: Renewable (Forests, wildlife & water) and non renewable (Water, soil, minerals and energy).

Unit – II Environmental pollution I: General outline and various types of pollutants. A detailed account of pollution of water, air and soil. Environmental pollution II: Sources and remedies for thermal, noise, radiation industrial chemicals, agrochemicals, insecticides & pesticides and household pollutants. Solid waste Management.

Unit – III Green house effect, ozone layer depletion, El Nino and La Nina effects. Radiation and environment: Types of radiation, fall effects and effects of nuclear radiation accidents. Basic concepts of bioaccumulation, biomagnifications and biodegradation of pollutants.

Unit – IV Wild life conservation: Vanishing and threatened animals and plants with special reference to Rajasthan, wild life management efforts by government and non government organizations. Impact of urbanization: Development and distribution of urban centers, factors, problems and the solutions of urbanization: Brief idea of human population with special reference to India and Rajasthan. Space ecology: Space problems and their solutions, space ecosystem and space colonization. 12. Sustainable environment.

Paper-II: Development Biology

Unit - I

Gametogenesis: Spermatogenesis, oogenesis, vitellogenesis and egg membranes. Fertilization: Sperm-egg interactions, biochemical events and post fertilization events Parthenogenesis.

Unit - II

Types of animal eggs, patterns of cleavage, fate maps, germ layers, gastrulation and cell lineage. Extra embryonic membranes, types and physiology of placenta. Organizer concept and induction process.

Unit – III Organogenesis of heart, kidney, nervous system and sense organs. Post-embryonic developments: Insects and amphibians. Regeneration in invertebrates and vertebrates.

Unit – IV: Various types of stem cells and applications (with special reference to embryonic stem cells). Cloning of animals: Nuclear embryonic transfer techniques, nuclear transfer techniques and embryonic or therapeutic cloning. Teratological effects of xenobiotics. Ageing: Concepts and models.

Paper-III: Evolution

Unit – I 1. Concept of evolution. 2. Origin of life on earth. 3. Origin of prokaryotic and eukaryotic cells.

Unit – II 4. Variations, mutations, recombination, ploidy isolation, natural selection: evolution in action. Concept of species and speciation. Molecular phylogeny: Phylogeny of horse. Molecular drive.

Unit – III Adaptations: Mimicry. Polymorphism: Population genetics, genetic drift and Hardy-Weinberg law. Macro- and micro-evolution, evolution of man.

Unit - IV Zoogeography: Principles and concepts of parallelism, endemism etc and factors influencing animal distribution.. Zoogeographical realms and faunal peculiarities, evolution of realms, plate tectonics & continental drifts and island zoogeography.

Paper-IV: Applied Zoology-I

Unit – I: The scope and history of microbiology. Major characteristics of microorganisms. Microbial classification, nomenclature and identification.

Unit – II: Bacteria: Morphology, fine structure, cultivation, reproduction & growth, pure culture and characteristics. Bacterial nucleic acids..

Unit - III

The world of bacteria- Classification, morphology and characteristics: Gram negative bacteria (*Pseudomonas*, *E.coli*, *Acetobacter*, *Nitrobacter* & *Thiobacter*), Gram positive bacteria (*Lactobacillus* & *Enterococcus*), bacteria with unusual properties and Gram positive filamentous bacteria (*Actinomycetes*). Microorganisms: General characteristics of fungi (molds and yeast), algae, protozoa and viruses.

Medical Zoology: Role of normal flora, Normal flora as pathogens, brief introduction to pathogenic microbes, viruses (Pox virus, Herpes virus, Adenovirus, Hepatitis virus, HIV & ADS virus), rickettsia, spirochetes, staphylococcus, streptococcus, pneumococcus, haemophilus, *Mycobacterium tuberculosis* and clostridium.

Unit – IV : Brief account of life history, mode of infection and pathogenicity: Entamoeba, Trypanosoma, Leishmania, Plasmodium, Wucheria and Dracunculus. Arthropods as vectors of human diseases: Malaria, Dengue, Filariasis, Japanese encephalitis and Plague.

Paper-XVIII: Applied Zoology-II

Unit - I

1. Bacteria and genetic engineering (outline idea only): Benefits of genetic engineering, potential hazards and regulations of genetic engineering
2. Enzymology of genetic engineering: Restriction enzymes, DNA ligase and polymerase.
3. Monoclonal antibodies and their applications.

Analysis and expression of cloned gene in the host cells: Southern blotting, Northern blotting, *In-situ* hybridization, PCR (Polymerase chain reaction) and DNA finger printing

Unit - I

5. Protoplast fusion in prokaryotes and eukaryotes.
6. Cloning vehicles: Plasmids, cosmids, lambda phage, charon phage, shuttle vectors, DNA plasmids and yeast plasmids.
7. Introduction of cloned genes into the host cells: Transformation and transduction.
8. Medical biotechnology: Gene therapy.

Unit - I

9. Transgenic animals and their uses.
10. Brief account of cloning: Genomic research, its advantages and disadvantages.
11. Biotechnology in medicine (outline idea only): Antibiotics, vaccines, enzymes, vitamins, steroids and artificial blood.

Unit - I

12. Environmental biotechnology (outline idea only): metal and petroleum recovery, pest control and waste water treatment.
13. Food, drinks and dairy biotechnology (outline idea only): Microbial spoilage and food preservation, fermented food production: dairy products, alcoholic beverage and vinegar.

Development Biology

(with the help of models /charts/CD-ROM's/ high resolution picture/video's etc.)

Unit-I Study of frog/toad development: Egg, cleavage, blastula, gastrula, neurala, tail bud, mature tadpole larva, metamorphic stages and froglet/toadlet. Histological slides: Cleavage, blastula, gastrula, neurula and tail bud. Study of living tadpole larva and its metamorphosis.

UnitII Study of Chick development: Whole mounts: 18 hrs, 21 hrs, 24 hrs, 33 hrs 48hrs, 72 hrs and 98 hrs of incubation. Study of chick development through window and blastoderm mounting. Study of various foetal envelopes in a 10-12 day chick embryos (amnion, chorion, allantois and yolk sac).

UNIT III. Evolution Study of evolution of man with help of models. Numerical problems based on population genetics.

UnitIV Applied Zoology-1

Preparation and use of culture media for microbes. Study of microbes in food material (curd and milk). Preparation of bacterial culture (water, air, soil/sludge)-Spread plate and streaking method. Preparation of bacterial slides (water, air soil/sludge) (simple stain, negative stain & differential stain): Gram positive bacteria, Gram negative bacteria and Gram positive filamentous bacteria. Preparation of culture media for fungus and its identification. Study of microscopic slides: *Entamoeba*, *Trypanosoma*, *Leishmania*, *Plasmodium*, *Wucheria* and *Dracunculus*. Visit to Dairy/wine processing unit. Submit a report.

Unit-V Applied Zoology-2

1. Isolation of DNA from onion.
2. Genomic DNA isolation from eukaryotic cells (cheek and yeast).
3. Small scale preparation of plasmid DNA.
4. Restriction digestion and agarose gel electrophoresis of genomic DNA and plasmid DNA.

B.Sc. Zoology (Hons.)

Scheme of practical examination and Distribution of marks

8 Hrs. (2 days, 4hrs/day) Min. marks: 40

Max. marks :100 r day

Regular

1nd day

Environmental Biology	10
Biotechnology (Applied Zoology)	10/15
(Marks of the observation and result-05 to be given the next day if required)	
Evolution	10
Viva voce	05
Class Record 05	
Seminar/Project Report/Collection	05

2nd day

1. Development Biology	09
2. Biotechnology	05
(Observations and results of the 1 st day experiment if any)	
3. Microbiology	10
4. Identifications and Comments on spots (1 to 8)	16
5. Viva voce	05
6. Class Record	05
7. Seminar /Project Report Collection	05

Notes:

1. With reference to whole mounts and museum specimens the animal types may be substituted with diagrams/photographs/models etc.
2. Students will keep records of all work done in the practical records.

3. It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.
4. The details methodology may be asked to be written where ever is necessary.

Recommended Books

1. Alexander R. M: The chordates, Cambridge University Press. 1975. Balinsky
2. B. I. and Fabian BC: Introduction to Embryology, CENGAGE Learning 2012.
3. Barnes R. D: Invertebrate Zoology, W. B. Saunders. 1969.
4. Berril N.J: Development Biology, Tata McGraw Hill. 1971.
5. Conn EE, Stumpf PK, Bruening G, Doi, RH: Outline of Biochemistry. 5th edition. John Wiley & Sons, 1987.
6. Davenport R.: An Outline of Animal Development. Addison-Wesley Longman Inc. 1979.
7. De Robertis EDP and De Robertis Jr EMF. Cell and Molecular Biology. 8th edition Lippincot Williams & Wilkins. 2006.
8. Gasque: CD Manual of laboratory, experiences Cell Biology Mc Caraw-Hill Professional Publishing 1989.
9. Barrett KE, Barman SM, Boctano, S and Brooks HL. Ganongs: Review of Medical Physiology. 24" edition Mc Graw Hill Education India Pvt. Ltd. 2012
10. Giese A. C: Cell Physiology. 4" Edition, Saunders 1973.
11. Gilbert SF and Singer SR: Development Biology. Sinauer Associates; 9th edition.2010.
12. Glick BR., Paeternak JJ: Molecular Biotechnology, 4th edition ASM Press, 2010.
13. Grant: Biology of Developmental System.
14. Hyman LH: The Invertebrates, Vol1-6, Mc Graw Hill.
15. Kotpal R. L: Modern Text Book of Zoology: Invertebrates. Rastogi Publications. 2012.
16. Lal SS: Practical Zoology Invertebrate. 11 revised edition, Rastogi Publications 2014.
18. Lodish H, Berk A, Kaiser CA, Krieger M, Bertscher A, Ploegh H, Amon A, Scott M P. Molecular Cell Biology. 7th edition. Mac Millian High Education (International edition) England. 2013.
19. Meyers R. A: Molecular Biology and Biotechnology (A comprehensive Desk References John Wiley & Sons 1995.
20. Odum: Fundamentals of Ecology. Thomson Books/Cole 2005.
21. Odume: Ecology: A Bridge between science and society Sinauer Associates 1997.
22. Old RW and Primrose SB: Principles of Gene Manipulation: An Introduction to Genetic Engineering.
23. Primrose S. B. and. Twyman R. M: Principles of Gene Manipulation and Genomics. John Wiley &
24. Rana S. V. S: Environmental Studies. 4th edition. Rastogi Publications 2012.
25. Eckert R, Randall D. J. Burggen W, French K: Eckert Animal Physiology and Burggren WW & Co.
26. Rao KV: Development Biology: A Modern Synthesis. Oxford and LBH Publishing. 1994.
27. Rastogi VB: Animal Distribution, Evolution and Development Biology. Kedar Nath Ram Nath.
28. Rastogi VB: Evolutionary Biology. Kedar Nath Ram Nath Education Publisher.
29. Sharma P. D: Environmental Biology and Toxicology. 3rd edition Rastogi Publications 2013.
30. Sharma P. D: Ecology and environment. 12h revised edition, Rastogi Publications 2014-2015.
31. Verma PS and Agarwal VK: Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. 144
32. Verma PS and Agarwal VK: Chordate Embryology: Development Biology. S. Chand & Company Ltd.
33. Verma PS. A Manual of Practical Zoology: Invertebrates. S. Chand & Co. Ltd. New Delhi. 1971.
34. Voet D and Voet JG: Biochemistry. John Wiley & Sons, New York. 1990.
35. Rastogi VB Organic Evolution 6th edition Kedar Nath Ram Nath Publications, Meerut, Delhi. 1993.
36. Rastogi VB and Jayaraj MS Animal Ecology & Distribution of animals Kedar Nath Ram Nath Publications, Meerut, Delhi, 1983.
