

Revised Latest Edition

COURSE OF STUDY

VEER KUNWAR SINGH UNIVERSITY



B.Sc. PART-III

**PASS & HONOURS
COURSE**

**THREE YEAR INTEGRATED DEGREE COURSE
FROM SESSION ON WARD**

Rs. 20/-

वीर कुँवर सिंह विश्वविद्यालय, आरा

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B. Sc. PART - III

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B.Sc. PHYSICS
Part-III
(HONOURS)

The Course shall consist of three Theory papers V, VI and VII each of 100 marks. The pass marks in the three theory papers taken together will be 135 and the examination in each will be of 3 hours duration. There will be Two practical papers VIII A. and VIII B each of 50 marks and 6 hours duration. The pass marks taken together will be 45.

The following will be the detailed Courses—

Paper-V
THEORY

Time : 3 Hours

Full Marks :75

10 questions to be set, 5 to be answered. Question number one will be objective (20 Questions) and it will be Compulsory. 3 questions will be set from each group A, Band C. Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A

MATHEMATICAL PHYSICS:

3 Questions

Curvilinear Coordinates, Cartesian, Spherical, Polar and Cylindrical Coordinates. Orthogonal transformation of coordinates, Scalar, Vector, Scala and vector fields, Divergence and curl. Line surface and volume integrals Theorem of Gauss, Stoke and Green. Tensor and its elementary properties Partial differential equations and its solution by separation of variables, Laplace's equation and its solution, Wave equation and its solution Poisson's equation and its solution. Function of complex variable, Cauchy-Rieman equation. Zeros and poles, Taylor and Laurentz Theorems, Cauchy's integral Theorem, Residu Theorem Integration of complex functions.

Group-B

CLASSICAL MECHANICS:

3 Question

Hamilton's principle, Euler-Lagrange's equation, Principle of least action Conservation theorems and symmetry properties, Application of Hamiltonian Dynamic to simple problem-Charged particle in an electromagnetic field (not relativistic cases), Laws of motion of rigid body, Moment of inertia and Product of inertia, Eulerian angle. Euler's equation of Motion of a rigid body. Gryroscope motion. Motion of symmetrical top, Canonical transformation. Example of Canonical transformation. Contact transformation, Hamilton-Jacobi equation Action angle variations.

Group-C

3 Question

QUANTUM MECHANICS:

Inadequacy of classical mechanics Dual nature of matter and radiation. De Broglie's. Concept of state. The correspondence principle. Postulates of Quantum mechanics. Eigen functions and eigen values of Hamilton operators. Uncertainty relations.

Schrodinger wave equation and its physical meaning, its application to problems of free particle, Transmission of particle through potential step. One dimensional square well particle in a box. Linear harmonic oscillator. Rigid rotator. Hydrogen atom. Commutation rules of orbital angular momentum. Their eigen functions, eigen values. Spin half angular momentum. Pauli's spin matrices, Pauli spin operators. Symmetric and anti symmetric wave functions, Pauli's exclusion principle.

Paper-VI
THEORY

Time : 3 Hours

Full Marks :75

10 questions to be set, 5 be answered. Question number one will be objective (20 Questions) and it will be Compulsory. 4 questions will be set from Group-A, 2 from Group-B and 3 from Group-C Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A

STATISTICAL PHYSICS:

3 Questions

The fundamental assumption of statistical mechanics, Probability distribution and entropy, Partition function and its Conversion to the thermodynamic functions, Sackur-Tetrode equation and Gibb's paradox.

Elements of ensemble theory and Liouville's Theorem Canonical ensemble and thermodynamics. Energy fluctuations in the canonical ensemble. Grand Canonical ensemble and thermodynamics Density and energy fluctuation in the grand Canonical ensemble, Simple application of ensemble theories to perfect gas.

Boltzmann distribution, fermi-Dirac distribution Bose-Einstein Distribution and their Simple application, Radial distribution function and its relation to thermodynamics functions. A brief introduction to first and second order phase transformation. Critical exponent, Lsing model in Zeroth approximation, Introduction to Fluctuations. The probability of thermodynamics fluctuations.

Group-B

ELECTRONICS:

3 Questions

Thermionic-Rechardson's equation and its experimental verification. Child-Langmuir equation, Schottky effect. Semi conductor devices, p-n junction and zenor diode, BJT and FET transistors, opto-electrical devices. Photo devices, LDR photo voltaic cell, photo transistor.

CIRCUIT THEORY:

Coupled LCR Circuits, Super position theorem, Thevenin and Reciprocity Theorems, Maximum power transfer theorem, One part and two part network (only h-parameter) T and Pi equivalence of two part network, Ladder network and constant K filters (low, high and band pass) Attenuators.

Group-C

3

SOLID STATE ELECTRONIC CIRCUIT:**Questions**

Equivalent Circuit of BJT and FET, Half wave and full-wave rectifiers. Power supply with specific reference to smoothing Circuits and voltage stabilization by cold Cathode valve and zenor diode. A.F Amplifiers (R.C Coupled amplifier) Feedback amplifiers, Pushpull power amplifier, Simple Circuits for oscillation. L.C. (Hartley and colpitt's) Oscillator, R.C oscillator, Astable Multivibrator, Principle of amplitude modulation, amplitude modulator average and envelop detection, radio receiver, super hetrodyne receivers, Simple idea of transmitters (with block diagram) CRO and its application. Logic Circuits AND, OR, NAND, NOR operation with the help of simple logic gates. Types of Computers and their basic Components, Input Output devices, Concept of hardware and software. BITS and BYTES Computer Programming of some simple mathematical problem in BASIC and FORTRAN Languages.

Paper-VII**THEORY**

Time :3 Hours

Full Marks:75

10 questions to be set, 5 to be answered. Question number one will be objective (20 Questions) and it will be Compulsory. 3 questions will be set from each group A and C. Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A**PLASMA AND CLASSICAL ELECTRODYNAMICS:**

3 Ques.

Microscopic and Macroscopic properties of Plasma. Plasma oscillations, Debye's potential. Wave propagation in isotropic plasma lonospheric reflection, Pinch effect, Alfvén wave, Shaha's theory of ionisation.

Retarded and advanced potential, Field due to an oscillating current, Element Oscillating Dipole, Lienard-Wichart Potentials. Potential and field due to uniformly moving charge.

Convarience of Maxwell equation under Lorentz transformation Transformation equation for electromagnetic fields.

Group-B**SOLID STATE PHYSICS:**

3 Questions

Elements of crystallography, Bravais lattice, miller indices, Seven crystal system, Simple crystal structure of NaCl, CaCl₂ and diamond Interaction of X-

rays, Neutrons and Electrons with Diffraction of X-rays from a perfect Crystal, Bragg's law, Reciprocal lattice, Ewald Construction and Brillouin Zones.

Crystall binding, ionic, metallic, Covalent and vander waal's binding Vanderwaals--London interaction and Cohesive energy of inter gas crystals. madelung energy and Madelung constant.

Free electrons theory of metals. Heat Capacity of electron gas Electrical Conductivity of metals. Boltzmann-Transport equation Sommerfeld theory of electrical conductivity. Band Theory of solid.

Bloch's theorem, Kronig-Penny model, Distinction between metal Semi Conductor and Insulator, Intrinsic and Extrinsic semi Conductors Transistors, p-n Junction, rectifier, Hall-Effect.

Group-C

3 Questions

ATOMIC AND NUCLEAR PHYSICS:

Origin of atomic spectra, Bohr's theory and Bohr-Sommerfeld theory of hydrogen atom, Spectra of alkali and alkaline, earth metals. Selection rules, Excitation potential. Fine Structure, Stern gerlach experiment Vector model of atom, Zeeman effect and Paschen Back effect of single valence atom. Moseley's law, origin of X-rays spectra.

Rotational Vibrational spectra of diatomic molecules, Rotation Vibration and electronic bands, Introduction to NMR, ESR, Laser spectroscopy.

General Properties of nuclear mass, Charge spin, static magnetic moment, size and stability, Nuclear models, liquid drop model and mass formulae. The shell model, Classical theory of Rutherford Scattering.

Paper-VIII (A)**PRACTICAL**

Time : 6 Hours

Full Marks :50

The course shall be include the following experiments-

1. Junction Diode Characteristics.
2. Zener Diode Characteristics.
3. FET Characteristics
4. BJT Characteristics
5. BJT Characteristics (Common emitter)
6. VJT Characteristics
7. Frequency response of R-C amplifier
8. Effect of Negative Feedback of R-C amplifier
9. Properties of Hartley oscillator
10. Study of logic gates (AND, NAND, OR, NOR)
11. Verify the child's Langmuir law.
12. Study the load Characteristics of rectifier.
13. Study the plate modulated wave.
14. Multivibrator and study of its wave from.
15. Design and study of power supply.

Paper-VIII (B)

PRACTICAL

Time : 6 Hours

Full Marks :50

The course shall be include the following experiments-

1. Verification of Brewster's law
2. Verification of Fresnel's law of reflection and refraction of Polarised light.
3. Analysis of elliptically Polarised light a Babinet's Compensator.
4. Inductance of coil by Anderson's Bridge
5. Mutual Inductance by Carey-Foster Bridge
6. Frequency characteristic of Low pass filter.
7. e/m by Braun's tube and high pass filter.
8. e/m by Helical method.
9. Planck's constant by photo-cell method.
10. Power factor of A.C Fan by-
 - (i) Three Ammeter method
 - (ii) Three Voltmeter method.
11. e/m By Milliken's oil drop method.
12. Phase shift measurement using oscilloscope.
13. Measurement of band gap of given semi conductor.
14. A comparative study of series and parallel resonant circuits and
 - (a) Measurement of 'Q' of the circuit
 - (b) Measurement of 'L' C and R
15. Study of Resonance in series L,C,R Circuit

B.Sc. PHYSICS**Part-III****(GENERAL)**

The course shall consist of one Theory paper of 75 marks. The pass marks will be 23 and the examination will be of 3 hours duration. There will be One Practical paper of 25 marks. The pass marks will be 10 and the examination will be of 3 hours duration.

The following will be the detailed Courses-

Paper-III**THEORY**

Time :3 Hours

Full Marks:75

10 questions to be set 5 to be answered. Question number one will be objective (15 Questions) and it will be Compulsory. 2 questions will be set from Group-A, 4 from Group-B and 3 from Group-C Atleast one question from each group is to be answered. All questions will be of equal marks.

Group-A**QUANTUM MECHANICS**

2 Questions

Need of Quantum mechanics, Dual nature of matter and radiation, Debroglie's relation, Uncertainty principle, Postulates of Quantum Mechanics. Schrodinger wave equation and its application to the problems-

- (i) Particle in Box
- (ii) Particle in one dimensional square well.
- (iii) Transmission across a potential barrier.
- (iv) Linear harmonic oscillator.

Group-B**SOLID STATE PHYSICS:**

4 Questions

Crystal Structure, Bravais lattice, miller indices, Simple crystal structure of NaCl, CaCl_2 , Crystal binding, ionic, metallic, Covalent and Vander Waal's binding.

London interaction and Cohesive energy inert gas Crystal modelung energy and Madelung constant.

FREE ELECTRON:

Theory of metals, Heat Capacity of electron gas, Electrical Conductivity of metals. Band Theory of solid, Bloch's theorem. Distinction between metal, Semi Conductor and Insulator, Intrinsic and Extrinsic semi Conductors, Transistor and p-n Junction rectifier, Electrical Polarisation and displacement in materials. Local electric field in an atom. Dielectric Constant and polarisation. Langevin Debye equation.

THERMIONICS:

Recharadson's equation and its experimental verification. Child- Langmuir equation, Schottky's effect, Semi conductor devices-p-n Junction and Zener diode, BJT and FET transistors, opto electrical devices. Photo devices, LDR photo voltaic cell, Photo transistor.

CIRCUIT THEORY :

Coupled LCR Circuits, Super position theorem, Maximum power transfer theorem, One part and two part networks (only h-parameter), T and Pi equivalence of two part network, Ladder network.

Group-C**SOLID STATE ELECTRONIC CIRCUITS:**

3Questions

Equivalence Circuit of BJT and FET, Halfwave and full-wave rectifiers. Power supply with special reference to smoothing Circuits and Voltage stablization by cold Cathod valve and Zener diode. A F Amplifiers (R.C) Feedback amplifiers, Push pull power amplifier. R.C. oscillator, Astable Multivibrator. Solid state amplitude modulator, Logic Circuits AND, OR, NAND, NOR operation with the help of simple logic gates.

Types of Computers and it basic Components, Input and Output devices. Concept of hardware and software.

PRACTICAL PAPER

Full Marks : 25

Time : 3 Hrs

The course shall include the following experiments.

1. Junction Diode Characteristics.
2. Zener Diode Characteristics.
3. PFT Characteristics.
4. BJT Characteristics. (Common-base)
5. BJT Characteristics. (Common-emitter)
6. Frequency response of R-C Coupled amplifier
7. Study of logic gates (AND, OR, NOR)
8. *etm* by Helical method.

Chemistry (Hons)

B.Sc. Part-III

Paper-V

PHYSICAL CHEMISTRY

Full Marks:100

There will be TEN question each of twenty (20) marks including Question No. 1(one) will be of objective type and compulsory covering the entire syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group

GROUP-A

1. GASEOUS STATE:

Collision number, collision frequency, collision diameter and mean free path of molecules of a gas (including temperature and pressure dependence). Viscosity of gases, relation between mean free path and Co-efficient of Viscosity, temperature and pressure dependence of Viscosity (η), degree of freedom motions, principle of equipartition of energy, its use for determination of Avogadro's number.

2. SPECTROSCOPY:

Basic principles of different types of absorption, idea of IR, UV-VIS Spectroscopy.

3. PHOTOCHEMISTRY:

Basic principles, Lambert-Beer Law, Molar extinction coefficient, Stark Einstein law of photochemical equivalence, primary and secondary processes, examples of low and high quantum yield. Photochemical reaction such as $H_2 + Cl_2 \rightarrow HCl$, $H_2 + Br_2 \rightarrow HBr$ and decomposition of HI. Phosphorescence and fluorescence.

Elementary idea of electron spectroscopy and area of its applications.

GROUP-B

1. THERMODYNAMICS:

Derivations of law of mass action, molar elevation and molar depression constants, van't Hoff reaction isochore and isotherms Maxwell thermodynamic relations, partial molar quantities chemical potential, variation of chemical potential with temp and pressure Chemical potential in an ideal gas mixture. Absolute entropy and third law of thermodynamics.

2. PHASE EQUILIBRIUM:

Three component systems, idea of sorting out triangular coordinates, partially miscible liquids and role of added salts $Cl(NH_4)SO_4-H_2O$. Phase diagram of cement.

3. WAVE MECHANICS:

de-Broglie equation uncertainty principle, Schrodinger wave equation and its application of H-atom (only interpretation of solution and no solution). Idea of operators.

GROUP-C

1. CHEMICAL KINETICS:

Kinetics of third order reactions, half period, and its unit, kinetics of complex reaction-side reactions, opposing reactions and consecutive reaction, chain reactions.

2. ELECTROCHEMISTRY:

(a) Reversible and irreversible cells and electrodes, E.M.F. of a cell and its measurement, Galvanic cells, electrode potential and its origin, standard, electrode potential, Nernst equation determination of electrode potential concentration cells, definition, classification, E.M.F. of concentration cells with and without transference, liquid junction potential application of e.m.f. measurements.

(b) **Electrodes:** Hydrogen electrode calomel, electrode, quinone hydroquinone electrode, glass electrode, measurement of pH using hydrogen electrode.

(c) Transport number and its determination by Hittorf's and moving boundary methods, Abnormal transport number. Determination of men activity by e.m.f. method.

3. SURFACE CHEMISTRY:

Types of adsorption, adoption isotherms, Freundlich, Langmuir and Gibbs adoption isotherms, Limitations and applications.

B.Sc. Part-III (Hons)

Paper-VI

INORGANIC CHEMISTRY

Full Marks : 100

There will be TEN questions each of twenty (20) marks including Question No. 1 (one) will be of objective type and compulsory covering the entire syllabus.

Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

GROUP-C**1. ATOMIC STRUCTURE:**

Idea of wave mechanical model of atom, schrodinger equation and its derivation, significance of wave functions, Normal and orthogonal wave functions, Probability density pattern for H-atom (qualitative idea only and no derivation required), radial and angular wave functions, sign of wave functions.

2. CHEMICAL BONDING:

(a) Molecular orbital method (qualitative treatment only), LCAO combinations of s-s, p-p, p-d orbitals, Rules of LCAO bonding antibonding and non-bonding orbital simple M.O. diagrams of homonuclear diatomic molecules, calculation of bond order, Resonance.

(b) Metallic Bonding: M.O. method of explanation of bonding in metals, outline of structure of interstitial alloys and substitution alloys, super conductivity and its applications.

3. NUCLEAR CHEMISTRY :

Ground state properties of nucleus-constituents of nucleus, nuclear properties, binding energy per nucleon and stability of nucleus, α , β and γ emissions and their properties, concept of potential barrier, radioactive decay law, partial decay constant, half life and mean life periods. Features of $4n$, $4n+2$, $4n+3$ and $4n+1$ radioactive series, Nuclear fusion and stellar energy, synthesis of transuranic elements.

GROUP-B

1. General chemistry of the following elements with reference to their periodic position, important, compound their structures and uses.

- (a) Nitrogen, Phosphorus, arsenic, antimony and bismuth.
(b) Oxygen, sulphur, selenium tellurium.

2. Comparative chemistry of the following transition metals with reference to their P.T. position, oxidation states, complex formation and formation of organo metallic compounds.

- (a) V, Nb and Ta
(b) Cr, Mo and W
(c) Platinum metals.

3. General Chemistry of f-block elements: Electronic configuration and periodic position of lanthanides and actinides, lanthanide contraction and consequences, magnetic properties of lanthanides.

GROUP-C**I. Organometallic Chemistry :**

Definitions, nomenclature of simple organometallic compounds E.A.N rule ionic and electron deficient compounds, metal alkyls of group, 1, 2 and 13 elements. Elementary idea of carbonyls, nitrosyls and ferrocenes.

2. Inorganic Chemistry in Biological System:

Elementary idea of the role of the following biological systems : Na, K, Mg, Ca, Fe and Co.

3. Inorganic Chains, Rings Cages and clusters:

Elementary idea of the terms involved with examples, idea of catenation and intercatation chemistry and heteropolyanions, borazenes, boranes and metal-metal bonding.

B.Sc. Part-III (Hons)

Paper-VII

ORGANIC CHEMISTRY

Full Marks : 100

There will be TEN questions each of twenty (20) marks including Question No. 1 (one) will be of objective type and compulsory covering entire syllabus. Three questions will be set from each group out of FOUR to be answered selecting at least ONE from each group.

1. GENERAL PRINCIPLES:

Hyperconjugation, mesomeric effect, hydrogen bond intermediate species, their detection and characterisation, carbocation, carbanion, carbenes, nitrene and benzyne.

2. TYPES OF REACTIONS :

Nucleophilic substitution at saturated and unsaturated carbon electrophilic and nucleophilic substitution in benzene nucleus. Addition reactions: Electrophilic and nucleophilic elimination reactions-- H of Markovnikov's rule and Saytzeff's rule.

3. Name Reactions and Rearrangements (Definition & Mechanism only) Aldol condensation, Knoevenagel reaction, Claisen condensation, Mannich reaction, Michael reaction, Pinacol-Pinacolone rearrangement Wagner-Meerwein Mermein rearrangement, Benzilic acid rearrangement.

GROUP-B

1. (a) Polynuclear hydrocarbons. Naphthalene, anthracene and Phenanthrene.
(b) Amino acids.
(c) Heterocyclic compounds, Furan, thiophene, Pyrrole, Pyridine, quinoline and isoquinoline.

3. (a) Dyes:

AZO, TPM dyes Phthalein dyes, Zanthene dyes, Vat dyes (indigo including its structure and stereochemistry).

(b) Alkaloids and Terpenes: Brief idea of general methods of isolation and structural elucidation.

GROUP-C

1. DRUGS:
Sulpha drugs, Antimalarials, Antibiotics, Analgesics, Pyrogenic Sedatives, Antiseptics.
2. (a) Synthetic fuels and propellants.
(b) Explosives, insecticides, adhesives.
3. USES OF REAGENTS:
 HIO_4 , Lead Tetra Acetate, N.B.S. Br_2 , SeO_2

B.Sc. Part-III (Hons)
CHEMISTRY PRACTICAL
Paper-VIII

Time : 6 Hrs.

Full Marks : 100

1. Anyone experiment from the following 50 Marks
 - (a) Determination of molecular weight of volatile liquids by victor-Meyer method.
 - (b) Determination of surface tension of liquids using stalagmometer and calculation of parachor values.
 - (c) Determination of co-efficient of viscosity of liquids using ostwald viscometer.
 - (d) Determination of partition co-efficient of solutes between two immiscible liquids.
 - (e) Determination of rate constant for hydrolysis of ester catalysed by H^+ ions at room temperature.
 - (f) Determination of refractive index of liquids by Abbe refractometer and calculation of molecular refractivity.
 - (g) Thermochemistry : Heat of solution of solute in a solvent, heat of neutralization.
2. Grammetric Analysis of any one estimation of Ag^+ , Cu^{2+} , Ni^{2+} , Ba^{++} , Cl^- and SO_4^{2-} 25 Marks
3. Viva-Voce 15 Marks
4. Note book 10 Marks

B.Sc Part-III (General)
GROUP-A

PHYSICAL CHEMISTRY

Full Marks : 75

There will be TEN questions each of fifteen (15) marks including Question NO. 1 (one) will be of objective type and compulsory covering the entire syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

1. Physical properties of liquids and their application in establishing molecular structure: viscosity, surface tension and refractive index.
2. ELECTROCHEMISTRY:
 - (a) Standard electrode potential E.M.F. and application of e.m.f. measurements.
 - (b) Transport number and its measurement by Hittorf's method 3.
3. CHEMICAL KINETICS AND CATALYSIS:
 - (a) idea of side reactions, opposing reactions and consecutive reaction, Chain reactions.
 - (b) catalysis : Definition and classification, Theory of catalysis, ideas of acid base and enzyme catalysis.
4. PHOTOCHEMISTRY:
 - (a) Basic principles, Lambert-Beer Law, Star-Einstein Law of Photo chemical Equivalence, $\text{H}_2 + \text{Cl}_2$ and $\text{H}_2 + \text{Br}_2$ reactions (only reactions) Quantum yield, Phosphorescence, fluorescence, elementary idea of photoelectron spectrograph.

GROUP-B

INORGANIC CHEMISTRY

1. (a) Atomic Structure and Bonding : Idea of VBT and MOT (qualitative treatments only) MO correlation diagram for homonuclear diatomic molecules. Calculation of bond order on its basis.
(b) Complexes: E.A.N. rule, shapes of d-orbitals Nomenclature, isomerism.
2. Outline of the chemistry involved in the following industries cement, fuel and industrial gases.
3. Uses of organic reagents in inorganic analysis : EDTA Dimethyl glyoxime, L-nitroso, B-naphthol, cupferron.
4. Chemistry of the following elements and important compounds.
 - (a) N, P, As.
 - (b) O, S, Se.

GROUP-C

ORGANIC CHEMISTRY

1. STRUCTURE AND MECHANISM:

Hyperconjugation, carbonium and carbanion, carbene nitrene (imp. reactions involving nitrene formation) Addition reactions electrophilic and nucleophilic elimination reactions, saytzeff rule. Friedal Craft reaction, Pinacole-pinacolone rearrangement.
2. SYNTHETIC ORGANIC CHEMISTRY:
 - (a) Malonic ester and use in synthesis Acetoacetic ester (MC).
 - (b) Use of the following reagents in organic chemistry:
 Na , NHO_2 , LiAlH_4 and AlCl_3
3. Aromaticity and Huckel's Rule

B.Sc. Part-III (General)
CHEMISTRY PRACTICAL
PHYSICAL CHEMISTRY

TIME : 5 hours

Full Marks : 20 marks

1. One experiment to be set
 - (a) Determination of surface tension of liquids (e.g. Benzene, Acetone, Chloroform) using stalagmometer.
 - (b) Determination of Co-efficient of viscosity of liquid e.g. Benzene, Acetone, Chloroform using Ostwald Viscometer.
 - (c) Determination of Partition co-efficient of solutes between two immiscible liquids.
 - (d) Determination of Molecular Weight of volatile liquid by Victor Meyer Method.
2. Record of class work and viva-voce.

Part-III

B.A/B.Sc. (Hons.)

MATH

There will be twelve questions to be set in each and every paper (i.e. Paper-V, VI & VII) and six to be answered in each paper selecting at least one from each group. One question will be objective/ short answer will be compulsory. This question will be of twenty marks and the rest questions are each of sixteen marks. Paper VIII will be optional paper. ten questions to be answered.

Paper-V

Time : 3 Hours

Full Marks : 100

- | | | |
|--------------|---------------------|-----------|
| 1. Group-A : | Real Analysis | : 3 Ques. |
| 2. Group-B : | Riemann Integration | : 4 Ques. |
| 3. Group-C : | Infinite Series | : 4 Ques. |

Group-A

REAL ANALYSIS:

Function of two variables, limit, Repeated limits, Moore-osgood Theorem, Continuity and differentiability of function of two variables, Young's and Schwarz Condition of equality of F_{xy} and F_{yx} Implicit function theorem. Continuity and differentiability of functions of two variables. Taylor's theorem, maxima and Minima of two variables. (3 questions)

Group-B

RIEMANN INTEGRATIONS:

Definitions and Existence of R-integrals of bounded functions, Darboux Condition of integrality. Riemann integrability of continuous function

monotone functions. R-integral of function with finite number of discontinuities with discontinuous point as a finite number of limit point. Riemann-integral as the limit of a sum. Mean value theorem and fundamental theorems of Integral calculus (2 questions)

Improper integrals, convergence of an improper integral, comparison test, Dirichlets test, Beta and Gamma functions, their properties and relationship. Differentiation under integration (one question)

Double and triple integrals, Change of order of integration, line surface and volume integrals, Green, Gauss and Stokes theorem. (one question)

Group-C

INFINITE SERIES

Sequences and series of function and their point wise convergence. Uniform convergence of sequence and series of function. Weistrass M-test. Uniform convergence and Continuity Dini's test, Abel's test. Dirichlet's test Uniform convergence and integration uniform convergence and differentiation. (2 questions)

Infinite Product and its convergence and their mutual relationship. Double series, sum by rows, sum by columns, Pringsmeism theorem, Elementary notion of metric spaces and Topological spaces with examples (2 question)

Paper-VI

Time : 3 Hours

Full Marks : 100

- | | | |
|--------------|----------------|----------|
| 1. Group-A : | Groups | : 3 Ques |
| 2. Group-B : | Ring | : 4 Ques |
| 3. Group-C : | Linear Algebra | : 4 Ques |

Group-A

GROUP:

Centre of a group, Normalized, Conjugacy class Equation, Autoorphism, inner isomorphism, Commutative Sub groups, Direct product of two groups. Solvable Groups, Finite Groups. (3 questions)

Group-B

RING

Division ring, Polynomial ring, Imbedding of a ring without unity in a ring with unity. Imbedding of a ring and integral domain in a field. Characterization of a field. Quotient field, Polynomial over commutative ring. Prime and maximal ideals in commutative ring. Euclidian Domain, Principal ideal Domain, Unique factorization Domain. (4 questions)

Group-C

LINEAR ALGEBRA:

Vector Spaces, Spaces, Bases and dimension. Linear transformation, Matrix and linear transformation. Algebra of Linear transformation.

Rank and nullity of linear transformation. Dual spaces, Characteristic values, Characteristic vectors, Cayley-Hamilton's Theorem. (4 questions)

Paper-VII

Time : 3 Hours

Full Marks : 100

- | | | |
|------------|------------------------------|-----------|
| 1. Group-A | : Complex Analysis | : 3 Ques. |
| 2. Group-B | : (a) Attraction & Potential | : 2 Ques. |
| | (b) Hydrostatics | : 2 Ques. |
| 3. Group-C | : Differential Equation | : 4 Ques. |

Group-A**COMPLEX ANALYSIS:**

Complex numbers as ordered pairs, Geometric representation of complex numbers, Stereographic Projection. Continuity and differentiability of complex functions. Analytic function, Cauchy Riemann equation, Harmonic function, Elementary functions, Mapping by elementary function, Möbius transformations, Fixed points, Cross ratio, Inverse points, conformal mapping complex integration.

Group-B**ATTRACTION POTENTIAL AND HYDROSTATICS:**

- (a) Attraction and Potential: Attraction and potential of rod, rectangular and circular dishes, spherical shells, sphere (Laplace's and Poisson's Equations). Theorems on equal potential surfaces. (2 questions).
- (b) Hydrostatics: Pressure at a point, Thrust on a plan surface, centre of pressure, Metacentre Equilibrium of floating bodies. (2 questions).

Group-C**DIFFERENTIAL EQUATIONS**

Second order equations with variable co-efficient, solution of second order differential Equations with variable co-efficient Method of variation of Parameters. Total differential Equations in three independent Variables, Simultaneous differential Equations, Lagrange's Linear partial differential equations, standard forms, Charpit's method. Partial differential equation of higher order with Variable Co-efficient. Monge's Method.

Paper- VIII**(OPTIONAL PAPER)**

Students are required to study any one of the following optional papers-

1. NUMERICAL ANALYSIS:

Finite Central and divided differences, interpolating inverse interpolation Numerical differentiation, Numerical integration, Trapezoidal, Simpson's $1/3$ rd and $3/8$ th rules, Weddle's rule, Gauss quadrature formulae of iteration, Gregory's formulae and the Euler's-Mac Levin's formulae (3 questions).

Solution of difference equation of first order, General Solution, Linear differential equation with constant Co-efficient. Solution of ordinary differential equations-one step method, Euler's modified, Runge-Kutta methods, Methods of starting the solution and Milne-Simpson's Method (3 questions).

Simultaneous Linear Equations: Gauss elimination, Gauss-Jordan's method and relaxation methods (simple problem) (2 questions).

Finding roots of Polynomial Equations: Regular, false, Bisection, Newton-Raphson Method of several variables, Iterative method and its generalization. Significant figures and error of computation. (2 questions).

2. SPHERICAL TRIGONOMETRY AND ASTRONOMY:

Spherical Trigonometry: Spherical Triangle, Fundamental formulae (Cosine-sine, sine-Cosine, cotangent) Napier's and De Moivre's Analogies, Right angled triangles and Napier's rule (2 questions).

Astronomy: Celestial sphere, Definition, Different system of Coordinates, Phenomenon of rising and setting of stars, Twilight (2 questions). Solar System, Two body problem, Equation of relative motion (one question). Area Integral, Kepler's laws. Anomalies, Kepler's equation (one question). Stationary point-Phase of planet, Refraction, Simons-Bradley's and Cassini's formulae. Effect of refraction in the position of a body (2 questions). Annual aberration, Effect of aberration on celestial latitude and longitude. Effect of aberration on right ascension and declination, Parallax, Effect of parallax on latitude, longitude, R.A. and declination (2 questions).

3. NUMBER THEORY:

The Basic Representation Theorem, Linear Diophantine Equation, Fundamental Theorem of Arithmetic, Fermat's Little theorem and Wilson's theorems (2 questions).

Basic properties of Congruences, Residue System, Euler's theorem, Chinese Remainder theorem, Multiplicative arithmetic functions, The Euler's functions $F(n)$, $U(n)$, Möbius function and the function $G(n)$ and their simple properties, Möbius inversion formulae, Perfect number and the function $t(n)$ (3 questions). The quadratic reciprocity law, Euler's criterion. The Legendre Symbol and its properties and applications, Gauss theorem, Gauss quadratic reciprocity law, quadratic congruences with Composite module (3 questions).

Representation of integers as sums of square, Sums of two squares, Theorems lemma, Fermat's Theorem, Sums of four squares and Euler's lemma, Lagrange theorem.

4. PROBABILITY THEORY :

Event, Probability of an event, Sample space, A finite sample space, Mutually exclusive and complementary events, independent events, conditional probability (one question).

Axiom for probability in finite sample space, Product rule of probabilities in

a sample space, Baye's theorem, Random variables, and their probability function. Mathematical expectation and Mean absolute deviation, Variance, Standard Variation, Chebyshev's theorem for a probability distribution and frequency distribution of measurements. (3 questions)

Convergence of sequence of random variables, convergence in distributions, Convergence in probability, almost sure convergence, Convergence in a quadratic mean, Halley/Bary theorem. (3 questions)

Complex valued random variables Characteristic functions, inversion theorem, Continuity theorem, Distribution and Kolomgavov's in equality. Weak and strong laws of large numbers (3 questions).

Part-III

B.A. B.Sc. Mathematics

GENERAL COURSE

There will be sixteen questions to be set and eight to be answered selecting at least one from each group. One question will be objective/ short answer will be compulsory. This question will be of sixteen marks and the rest questions are of each of twelve marks.

Paper-III

Time: 3 Hours

Full Marks: 100

- | | | |
|-------------|----------------------|-----------|
| 1. Group-A: | Abstract Algebra | : 5 Ques. |
| 2. Group-B: | Complex Analysis | : 5 Ques. |
| 3. Group-C: | Hydrostatics | : 3 Ques. |
| 4. Group-D: | Attractive Potential | : 2 Ques. |

Group-A

ABSTRACT ALGEBRA:

Binary operations, Definitions of Group, Abelian and non abelian groups with example, Uniqueness of identity element and inverse of an element in a group. Cancellation laws in a group, Definition of a sub group and Cyclic group with examples, Definition of ring, integral domain and field with examples. Homomorphism and isomorphism in a group and ring. (5 questions).

Group-B

COMPLEX ANALYSIS:

Complex number as ordered pair, Geometric representation to complex numbers, Continuity and differentiability of a complex function. Analytic function, Cauchy's Riemann Equation, Harmonic function. Mapping by elementary function. Conformal mapping, Bilinear transformations. Inverse points, Cross ratio (5 questions)

Group-C

HYDROSTATIC:

Pressure at a point, Thrust on plane and curved surfaces, Centre of Pressure and meta centre. Equilibrating of floating bodies (3 questions)

Group-D

ATTRACTION AND POTENTIAL:

Attractive and Potential of a rod, Rectangular and Circular disc, Spherical shells, Spheres (laplaces and Poisson's equations). Theorems of Equi potential Surface. (2 questions).

B.Sc. Part-III

BOTANY HONOURS

There would be three theoretical and one practical papers in B.Sc. Part-III examinations carrying 100 marks in each paper.

Paper-V

BIOCHEMISTRY-MOLECULAR-BIOLOGY AND BIOTECHNOLOGY

Time : 3 Hours

Full Marks : 100

Ten questions has to be set. Question No. 1 will be objective type and compulsory covering the entire syllabus. Remaining 9 questions have to be set from three groups (A,B,C). Four questions are to be answered besides Question No. 1, selecting at least one from each group.

Group-A BIOCHEMISTRY:

- Celluar Chemistry** : Covalent and non covalent interactions; Hydrogen - bond ; stucture properties and biological significance of water ; pH and its significance; Buffers, (Both inorganic and orgainc) and its importance;
- Energy flow and enzymology**: Concept of free energy, energy transfer and redox potential; Classification and nomenclature of enzymes mode of action enzymes as biocatalysts; isoemzymes
- Nucleic acids** :Composition of nucleic acids and synthesis of nucleotides; DNA Structure - A,B & form of DNA; Denaturation and renaturation of DNA replication, DNA polymerases Different from of RNA and their roles.
- Aminoacids and protein** :Metabolism stucture characteristics and classification of aminoacids ;protein and non protein aminoacids; Types and structure of Proteins; Protein biosynthesis and its regulation.
- Carbohydrate**: Metabolism Classification and structure of various types of carbohydrates; biosynthesis and degradation of sucrose and starch.
- Lipid**:Metabolism Saturated and unsaturated fatty acids, biosynthesis of fatty acids, Oxidation of fatty acids. Storage and mobilization of fatty acids and liquids.
- Outline of secondary plant metabolites and their roles.

Group-B MOLECULAR BIOLOGY

1. DNA as genetic material : (Both Prokaryotes and Eukaryotes)
2. Genetic code ;
3. **Gene structure expression and regulation:** Gene concept; Organization of gene in Prokaryotes and eukaryotes; Operon concept; Gene regulation (Lac operon and tryp operon)
4. Interrupted genes; RNA Splicing
5. **Recombinant DNA Technology :**
Role of Vectors, Restriction enzymes; Cloning Strategies genomic and cDNA libraries; Southern and Northern blots; Polymerase chain reaction; DNA fingerprinting.

Group-C : PLANT-BIOTECHNOLOGY

1. Basic concept and scope of plant Biotechnology.
2. Plant cell and tissue culture: History, scope, concept of cellular differentiation and totipotency.
3. Organogenesis and embryogenesis : Fundamental aspects
4. Somatic hybridization: Isolation and culture of protoplast
5. Application of Plant tissue culture: Clonal propagation, elementary knowledge of conservation and storage of germplasm
6. **Genetic engineering of Plants:** Aims and development of transgenic plants; Agrobacterium as a natural genetic engineer.

Paper-VI**MICROBIOLOGY, PLANT PATHOLOGY AND AEROBIOLOGY**

Time : 3 Hours

Full Marks : 100

Ten questions has to set . Question No . 1 will be object type and compulsory covering the entire syllabus . Remaining 9 question have to be set from two groups (A,B) in which four question are to be answered besides Question No. 1 selection at least one from each group.

Group -A**MICROBIOLOGY**

1. **Discovery of microorganisms:** Systematic position of micro organisms in biological world ; classificaton and characreristic features of various group
2. Methods in microbiology : Sterilization methods; Preparation of culture media, Technique of isolation of microorganism, staining of Bacteria.
3. Ultra structure of microorganism: Structure and nature of TMV and Bacteriophage-T4 structure of Bacterial cells, General account of Mycoplasma and Actinomycetes.
4. Nutrition in Bacteria

5. Genetic recombination in Bacteria.
6. Role of microorganism in biogeochemical cylings of N₂ and C cycle; Biological N₂-fixation
7. **Industrial application of microorganisms:** Organic acids, Alcohol, Food processing, Milk Products, Antibiotics, Biopesticide- Preparations, Products from Genetically engineered microbes.
8. Microbial degradation of food grain in storage.

Group-B**PLANT PATHOLOGY**

1. General account of diseases caused by plant pathogens
2. Role of toxins and enzymes in plant diseases.
3. Important plant diseases of Bihar, Its etiology and control:
 - (a) Rust disease of wheat.
 - (b) Smut disease of wheat.
 - (c) Blast disease of rice juice.
 - (d) White rust of crucifers
 - (e) Late blight of Potato
 - (f) Wilt of Arhar
 - (g) Tobacco Mosaic virus.
 - (h) Tundu disease of wheat.
 - (i) Citrus Canker
 - (j) Little leaf of Brinjal
4. Definition, scope and concept & Aerobiology
5. Morphology & common. airborne biopartic lates pollen grains & fungus spores.
6. A brief idea of allergic and respiratory diseases-Asthma and rhinitis.

Paper-VII**SYSTEMATICS OF ANGIOSPERMS AND ENVIRONMENTAL BIOLOGY**

Time : 3 Hours

Full Marks : 100

Ten questions has to be set Question No. 1 would be objective type and compulsory covering the entire syllabus. Remaining 9 Questions have to be set from two groups. Four questions are to be answered besides Question No. 1, selecting not more than two from any group.

Group-A**SYSTEMATICS OF ANGIOSPERMS**

1. Introduction : Definition of systematics, aims and components of systematics, its significance, Origin of systematics with some exploration from Indian old treatises and modern systems of classifications

2. Systematics in Practice : Importance of herbarium specimens and the preparations, Role of herbaria and Botanical gardens; Keys for identification of plants.
3. Botanic nomenclature : Binomial nomenclature; ICBN principles Rule Rank and names, Type methods, Principles of priority and its limitations. Names of hybrids and cultivars.
4. Phylogeny of angiosperms: A general account of the origin and evolution of angiosperms.
5. System of Classification : Bentham and Hooker's system, Hutchinson system and Cronquist's system.
6. Modern trends in systematics : Taxonomy in relation to morphology, anatomy, embryology.
7. A comparative account of the diagnostic features relationship; and economic importance of the following families:
Magnoliaceae, Ranunculaceae, Nyctaginaceae, Amaranthaceae, Euphorbiaceae, Cucurbitaceae, Rubiaceae, Scrophulariaceae, Acanthaceae, Cyperaceae and Poaceae.

Group-B

ENVIRONMENTAL BIOLOGY

1. **Introduction** : Definition of environmental biology the components and dynamisms, homeostasis, relevance in welfare of human society.
2. **Earth as system** : Biosphere (Biomes)-hydrosphere, atmosphere and lithosphere;
3. **Environment** : Definition and concept; general account and adaptations water, soil and atmosphere, Components of environment-abiotic and biotic individuals, species, Populations, communities and their characteristics.
4. **Impact of human activity**: Pollution of water, soil and air, a brief account of environmental toxicology; incidence of noise pollution; Prevention and control of pollution; Global warming and Ozone depletion Biomagnification.
5. Role of national and international organizations in environmental management : Formulation of optimal models.
6. Bio-indicators.

Paper-VIII

PRACTICALS BASED ON

Paper-V,VI,&VII

Time : 6 Hours

Full Marks : 100

1. Chemical tests to demonstrate the presence of any one of the following: starch, sugar, -fat, alkaloids, flavonoids, tannins and protein in plant materials.
Or
To identify the amino acids in a mixture by resolving through paper chromatography or TLC 15
2. Colorimetric estimation of DNA using diphenylamine/RNA using orcinol. 15
3. preparation of media for tissue culture, sterilization and inoculation of Plant material.
Or Demonstration of techniques of in vitro culture of various explants. 15
4. Preparation of a solid culture medium or isolation and inoculation of Alternaria/Fusarium/Colletotrichum or study of local microbial diseases.
Or Identification of aerospora by cellotape method 10
5. Description of the locally available plant Genus only from the families Prescribed in the course.
6. To identify the Bacteria using method of Gram's Staining 10
7. Class records, herbaria and Tour Report. 10
8. Viva-Voce.

Part-III

B.Sc. BOTANY GENERAL

There shall be one theoretical paper carrying 75 marks and one practical paper carrying 25 marks.

Paper-III

Plant physiology, Biochemistry, Biotechnology,

Ecology and utilization of Plant

Time : 3 Hours

Full Marks: 75

Ten questions have to be set. Out of which Question I would be objective types compulsory. Remaining 9 Questions have to be set from two groups in which four questions are to be answered besides Question 1, selecting not more than two from any group.

Group-A**Plant physiology, biochemistry and biotechnology**

1. **Plant-water relationship** : Diffusion and osmosis; absorption, transport of water and transpiration, physiology of stomata.
2. **Mineral nutrition** :Essential macro and micro-elements and their role; mineral uptake, deficiency and toxicity symptoms.
3. **Transport of organic substance** : Mechanism of Phloem transport; source-sink relationship
4. **Photosynthesis** :Mechanism and factors; Respirations: aerobic and anaerobic (glycolysis, Krebs' cycle and electron transport)
5. **Nitrogen metabolism**:Nitrate reduction, amino-acids, Protein-Structure and types; N₂ Fixation.
6. **Enzymes** : Nomenclature, characteristics and types of enzymes; Regulation of activity and mechanism of action.
7. **Phytohormones**: Auxins, Gibberellins and cytokinis
8. **Growth and development** : Definition, Phases of growth and development; seed germination.
9. **Movements** :Tropic movement
10. **Biotechnology** :Definition, Basic aspect of Plant tissue culture cellular totipotency, differentiation and morphogenesis; salient achievement in crop technology. Brief idea of Restriction enzyme. cloning vector. products of genetic engineering.

Group-B**ECOLOGY ENVIRONMENTAL BIOLOGY AND UTILIZATION OF PLANTS**

1. **Plant and environment**: Water, soil, atmosphere, light, temperature and biota.
2. **Morphological, anatomical and physiological responses of plants to water** (Hydrophytes and Xerophytes), temperature (vernalization), light (photoperiodism) and salinity.
3. **Plant community and ecosystems**; succession-Hydrosere and Xerosere
4. **Major vegetational types of India**: Forests and Grasslands.
5. **Pollutions** : Rice, Maize, Potato, Sugarcane
6. **Food Plants**: Rice,maize, Potato, Sugarnace.
7. **Fibres** : Cotton and jute

8. **Vegetable Oils** : Mustard, Coconut, Groundnut
9. **Pulses** : Gram, Arhar, Masoor, Mung.
10. **Forest wealth of Bihar** with reference to timber yielding plants
11. **Important drug yielding plants** of your region
12. **Beverages** : Tea & Coffee
13. **Rubber**

PRACTICAL PAPER BASED ON**Paper-III**

Time:3 Hours

Full Marks:25

1. **Ecological adaptation in Hydrophytes, Xerophytes, Mesophytes Parasites and Epiphytes**
Or To determine minimum size of quadrates required for reliable estimate of biomass in grasslands 05
2. **Study of pH of different types of soil with the help of pH meter.**
Or To measure dissolved O₂ content in polluted and unpolluted water samples. 05
3. **Test for carbohydrate, Protein, amino acids and lipids.** 05
Or Compare the rate of transpiration between mesophytes and Xerophytes
Or O₂ is evolved durin photosynthesis
Or Compare the rate of imbibition of fatty and starchy seeds
Or Compare the rate of absorption and transpiration
Or Moll's experiment.
Or Demonstation of the technique of micro propagation by using different explants e.g. axillary buds shoot meristems
Comment upon spots 1-4 of utilization of plants as described in syllabus 05
- Class records 03
- Viva-voce 02

B.Sc. (Part-III)
Zoology General
Paper-III A
(Theory)

Time : 3 Hours

Five questions are to be set from each group, Students shall have to answer five questions attempting at least two from any group.

Group-A : ECOLOGY

1. Concept of Biosphere.
2. Definition, structure and functions of a typical ecosystem.
3. Major Ecosystems of the world and their features.
4. Abiotic and Biotic factors.
5. Biogeochemical Cycles of Oxygen, Nitrogen and carbon
6. Energy Flow in ecosystems.

ANIMAL BEHAVIOUR:

- (i) Scope of Ethology; Innate and Learned Behaviour.
- (ii) Parental care in fishes and Amphibians.
- (iii) Social Behaviour in insects.
- (iv) Migratory Behaviour in birds & fishes.

Group-B: PALAEOZOOLOGY AND ZOOGEOGRAPHY

- (i) Different Geological eras of the world, their climatic conditions and faunas.
- (ii) Zoogeographic realms of the World and their boundaries.
- (iii) Biogeographical distribution of animals in Oriental, Ethiopian and Australian regions.
- (iv) Fossils and their mode of formation.

ECONOMIC ZOOLOGY:

- (i) Seri culture, Lac culture and Pisciculture.
- (ii) Preliminary idea of the common pests of paddy & Wheat, their control.
- (iii) Vectors of Kalazar, Malaria, Filariasis, their Prevention and control.

Full Marks: 25
Time : 3 Hours

PRACTICAL
Paper-III B (General)
ECOLOGY, ANIMAL BEHAVIOUR, PALAEOZOOLOGY,
ZOOGEOGRAPHY & ECONOMIC ZOOLOGY

Full Marks: 25

Quantitative estimation of dissolved O ₂ in water with the help of Winkler's volumetric methods.	05
Determination of pH of different water/Soil samples.	02
Moisture content of soil & identification and comment on the organism present in water/soil samples.	03
4. Identification and comment on the specimen (spotting) on) Palaeozoology-Fossils.	06
i) Economic Zoology-Silk Yarn, Larva, Pupa, Adults of Silk Worm: Lac Sticks, Lac insect, Fishing gears, Museum specimens showing parental care; Mouth parts of male and female Culex, Anopheles, Sandfly and their different developmental stage.	
Paractical Records	04
Viva-voce	05

B.Sc. Honours (Part-III)
paper-V
(THEORY)

Time : 3 Hours

Full Marks : 100

All 10 questions are to be set out of which number 1 and 2 shall consist of objective (1×20 Marks) and short answer (4×5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

BIOCHEMISTRY:

- Structure and Classification of Protein, carbohydrate and Fats.
- Structure and Classification of Amino Acid.
- Metabolism of Carbohydrate: Glycogenesis, Glycolysis and Krebs' cycle
- Beta-oxidation of fatty acids.
- Vitamins-Types and functions
- Physiology (Mammals)
 - (i) Physiology of digestion
 - (ii) Physiology of respiration (ventilation of lungs and transport of gases).

- (iii) Physiology of excretion and Osmoregulation.
- (iv) Physiology of testicular and ovarian cycle.
- (v) Histology of the various Endocrine glands of Mammal
- (vi) Chemical nature and Physiological role of the Hormones secreted Adenophyphysis, Neurohypophysis, Adrenal, Thyroid, Islet Langerhans and Gonads.

B.Sc. Honours (Part-III)**Paper-VI
(THEORY)**

Time : 3 Hours

Full Marks: 10

In all 10 questions are to be set out of which number 1 and 2 shall consist of Objective (1x20 Marks) and short answer (4x5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

1. CELL BIOLOGY:

- (i) Ultra structure and function of the following cell organelles: Plasma membrane, Endoplasmic reticulum, Mitochondria, Golgi Complex, Ribosome, Chromosomes, Lysosomes, Nucleolus.
- (ii) Gametogenesis, Fertilization and Parthenogenesis.
- (iii) Elementary idea of Immunology : Lymphoid tissues and organs, Innate and Acquired immune response.

2. GENETICS

- (i) Linkage and crossing over. Structure and replication of DNA, Transcription and Translation.
- (ii) Chromosomal aberrations, the Genetic and Cytological manifestations and significance.
- (iii) Gene Mutation and Molecular Mechanism of its origin.
- (iv) Extra nuclear genetic system
- (v) Sex determination and sex linked inheritance.

3. ECONOMIC ZOOLOGY

- (i) Lac Culture
- (ii) Seri Culture
- (iii) Api. Culture
- (iv) Pisci Culture
- (v) Elementary idea of the common pests of paddy, wheat, sugarcane and vegetables and their control.

- (vi) vectors of Kalazar, Malaria and Filariasis, their biology, mode of infection, prevention and control.
- (vii) Wild-life conservation.

Paper-VII**EVOLUTION, ZOOGEOGRAPHY & PALEOZOOLOGY**

Time : 3 Hours

Full Marks :100

In all 10 questions are to be set out of which number 1 and 2 shall consist of Objective (1x20 Marks) and short answer (4x5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

1. EVOLUTION :

- (i) Sources of hereditary variation and their role in evolution.
- (ii) Principles of evolution : Lamarckism, Neo-Lamarckism, Darwinism & Neo Darwinism.
- (iii) Isolating mechanism and their role in evolution.
- (iv) Hardy-Wienberg law and genetic equilibrium.
- (v) Fossil history of horse & Man.
- (vi) Micro, Macro and Mega evolution.

2. ZOOGEOGRAPHY & PALEOZOOLOGY

- (i) Zoogeographical realms of the world, their boundaries and climatic peculiarities.
- (ii) Characteristic & Peculiar fauna of Oriental, Ethiopian and Australian regions.
- (iii) Characteristic offland fauna.
- (iv) Theories & Principles pertaining to animal distribution.
- (v) Different geological of the world, their duration and climatic conditions.
- (vi) Faunistic peculiarities of Paleozoic, Mesozoic and Cenozoic eras.
- (vii) Fossil : their mode of formation & age determination.

Paper-VIII**PRACTICAL****BIOCHEMISTRY, PHYSIOLOGY & ENDOCRINOLOGY**

Time : 8 Hours

Full Marks :100

FIRST SITTING**1. BIOCHEMISTRY :**

10

- (i) Benedicts test for reducing sugar.

- (ii) Molisch's test
 (iii) Iodine test for starch and glycogen
 (iv) Ninhydrin reaction for glycine/tyrosine/tryptophan.
 (v) Millon's reaction for glycine/ tyrosine/phenylalanine.

2. **Physiology :** 7×2=14

Experiments to be performed in frog, bird/ mammal. (Two experiments)

- (i) Enumeration of total RBC.
 (ii) Estimation of hemoglobin (gm/100ml) in blood.
 (iii) Determination of ESR of blood.
 (iv) Determination of bleeding and clotting time.
 (v) Determination of O₂ uptake by terrestrial animal.
 (vi) Simple heart-beat and muscle curve by drum method.
3. Dissection and display of any four of the following endocrine glands in a mammal-gonad, thyroid, adrenal, Pancreas, Spleen, Thymus, Pituitary.
4. Identification and comment upon the histological slides (five in number) of the following : Pituitary, Adrenal, Ovary, Testes, Islets of Langerhans, Thymus, Thyroid. Parathyroid and Vaginal smears, Bone, cartilage, ear eye, spleen.

SECOND SITTING

A. CELL BIOLOGY :

1. Vital staining of secretory granules in salivary glands of Cockroach and Mitochondria in the buccal epithelium. 12

B. GENETICS :

1. Aceto carmine stained squash preparation of the onion root tips and tests of grasshopper to demonstrate stage of mitotic divisions respectively. 10
2. Aceto carmine preparation of the giant chromosomes of the Chironomus/ Drosophila larvae.

C. EVOLUTION AND PLEONTOLOGY:

1. Serial homology as exhibited by the appendages of prawn. 4×2=8
 2. Homology and Analogy as exhibited by the wings of birds, bat and insect.
 4. Study of Fossils.
 5. Identification and comment upon the specimens/ slides on-
 Economic Zoology - 3 Nos. and 10
 Cytology - 2 Nos 10
 6. Practical Record 10
 7. Viva-Voce 10

**GENERAL HONOURS
 GENERAL AND ENVIRONMENT STUDIES (GES)**

सामान्य अध्ययन एवं पर्यावरण अध्ययन

Time : Hours]

Marks :100]

GENERAL STUDIES

सामान्य अध्ययन

50 Marks

Group -A

1. Social Reform movements in the 19th and 20th Century.
19वीं एवं 20वीं शताब्दी में समाजिक सुधार आन्दोलन।
2. National Freedom Struggle since 1857 A.D. and Attainment of Independence.
1857 ई० से स्वाधीनता प्राप्ति तक राष्ट्रीय स्वतंत्रता संग्राम।
3. National Cultural Heritage.
राष्ट्रीय सांस्कृतिक विरासत।
4. General Awareness about important provisions of India Constitution.
भारतीय संविधान के महत्वपूर्ण प्रावधानों का परिचय।
5. Planning for Development in Post-Independent India
भारत की स्वतंत्रता के पश्चात् विकास हेतु योजना।
 (i) Agricultural and Industrial Development
कृषि एवं औद्योगिक विकास।
 (ii) Problems of Poverty and unemployment
गरीबी एवं बेरोजगारी की समस्याएँ।
 (iii) Priority of Reconstruction of Bihar
बिहार के पुनर्निर्माण की समस्याएँ।
 (iv) Priority of Reconstruction of Bihar
बिहार के पुनर्निर्माण की प्राथमिकता।
 (v) Role of Gram Panchayat in eradication of poverty.
गरीबी उन्मूलन में ग्राम पंचायत की भूमिका।
6. टिप्पणी लिखें:
 (i) United nations and its major agencies
संयुक्त राष्ट्रसंघ एवं उसके प्रमुख अंग
 (ii) Human rights
मानवाधिकार।

(iii) Value Education and
मूल्यपरक शिक्षा।

(iv) Consument awareness.
उपभोक्ता जागरूकता।

7. Fascinating World Living being.
सजीव जगत का आश्चर्यजनक संसार।
8. Elementary knowledge of Physics
भौतिक विज्ञान का प्रारंभिक ज्ञान।
9. Chemistry in Action
रसायनशास्त्र : एक दृष्टि में।
10. Modern achimements in Science and Technology.
विज्ञान एवं प्रौद्योगिकी में आधुनिक उपलब्धियाँ

ENVIRONMENTAL STUDIES

Group-B

50 Marks

1. National resources-Land water, Forest and Mineral resources.
प्राकृतिक संसाधन: भूमि, जल, वन एवं खनिज सम्पदा।
2. Concept and its conservation-Hot spots and thearts to biodiversity.
पारिस्थितिकी-कुछ प्रमुख पारिस्थितिकियों का प्रारंभिक ज्ञान।
3. Biodiversity and its conservation- Hot spots and threats to biodiversity.
जैव विविधता एवं उनका, संरक्षण महत्वपूर्ण जैव-स्थल एवं जैव विधिता को खतरे के कारण।
4. Pollution cause, effects and control measures.
प्रदूषण के कारण, कुप्रभाव एवं रोकथाम के उपाय।
5. Relevance and Sustainable development, Conservation and Wate Land Reclanation.
जीवन धारण करने योग्य विकास की प्रासंगिकता, जल संरक्षण एवं अवशिष्ट भूमि पुनप्राप्ति।
6. Public awarenes about and Environment issue, Population growth & its impact on Environment-Woman and Child Development-AIDS.
पर्यावरण संबंधी विषयों के बारे में जनता की जागरूकता, जनसंख्या वृद्धि एवं उसका पर्यावरण पर प्रभाव-(i)महिला एवं बाल विकास (ii) एड्स रोग।

