University of Rajasthan Jaipur

SYLLABUS

B.Sc. (Hons.) Part-III

Examination - 2019

CONTENTS

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SCHEME OF EXAMINATION
B.Sc. (Honours) Part-III
(10+2+3 Pattern)

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

Successful candidates will be classified as under :

First Division   60% } of the aggregate marks prescribed both in Honours and subsidiary subject of Part I, Part II and Part III Examinations taken together.

Second Division   50% }

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

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

A candidate shall be required to offer one Honours subject and one subsidiary subject out of the following subjects to the condition that he has offered by him as optional subjects at the First Year examination of the University or an examination recognised by the University as equivalent thereto :

1.
2.
3.
4. Bot
5. Mathematics
6. Geography
7. Psychology

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

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1. <u>PHYSICS</u>

B. Sc Honors PART III

Paper IX: Basic Computer Physics and Applications

Unit- I

Algorithm development: Problem analysis, flow chart, decision tables; Examples of simple algorithms; Programme Design: Debugging syntax error, run-time error, logical error, programme verification and testing.

Data Representation: Representation of positive and negative numbers, fixed point representation, floating point representation. Arithmetic operations with normalized floating point numbers and its consequences, character representation, rounding off of numbers, absolute and relative errors, error detection and error correcting codes.

Unit- II

Programming Language C:

Numeric constants, declaring variable names, character data type; Arithmetic operators, hierarchy of operations, assignment statements, Input/output statements; Library functions, Elementary Programmes in C for numeric and string processing.

Conditional statements: relational operators; Arithmetic IF and Logical IF statements; Unconditional transfer: GO TO statement; Looping: DO loops, nested loops; Functions and subroutines; Subscripted variables: vectors and arrays; Writing and executing C programmes. Programmes in C to (i) compute magnetic field due to a current carrying coil (ii) compute electric field due to a system of point charges (iii) study frequency response of an LCR circuit (iv); Evaluate Bessel's function, Legendre function, Hermite Polynomial, Languerre's Polynomial by series expansion. Evaluation of simple functions by Taylor Series Expansion.

Unit- III

Iterative Methods: Solution of algebraic and transcendental equations using bisection method, method of false position, Newton-Raphson method; Complex zeros, zeros of polynomials; Simple applications related to Physics like programmes in C to evaluate zeros of simple functions.

Interpolation: Lagrange interpolation, Difference tables, truncation error in interpolation, Spline interpolation.

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Unit- IV

Least Square Approximation: Linear regression, Polynomial regression, fitting exponential and trigonometric functions, approximation of functions by Taylor' series and Chebyshev polynomials, curve fitting and polynomial fitting; Programmes in C related to physics on above topics.

Numerical Integration: Trapezoidal rule, Simpson's rule, errors in integration formulae, Gaussian quadrature formulae. Programmes in C related to physics on above topics.

Unit- V

Numerical Solution of Ordinary differential equations: Taylor's method, Euler's method and Runge-Kutta methods; Programmes in C related to physics on above topics.

Numerical Solution of Partial Differential Equations

Finite Difference methods for solution of (i) The diffusion equation (ii) the wave equation and (iii) the Laplace equation; Programmes in C related to physics on above topics.

Reference Books:

1. Computer Science, R. Dheen Dayalue (Tata Mc Graw Hill)

2. Computer System Architecture, Morris-Mano (Prentice Hall of India)

3. Computer Oriented Numerical Methods, V. Rajaraman (Prentice Hall of India)

4. Mathematical Methods, Potter and Goldberg (Prentice Hall of India)

5. Computational Methods for Partial Differential Equations, M. K. Jain, S. R. K. Iyenger, R. K. Jain, (New Age International)

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Paper-X : Introductory Nuclear and Particle Physics

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

Unit I : Basic Nuclear Characteristics

(i) Nuclear mass, nuclear size and nuclear matter—The mass table, binding energy of nucleons, nuclear size, semiempirical mass formula, Nuclear matter-characteristics, theory of binding energy and the pairing energy, Nuclear stability and abundance of nuclides. Spin and parity of nuclear sates, magnetic dipole and electric quadrupole moments of nucleus. (Qualitative discussion only).

(ii) General nature of force between nucleons, scattering of neutrons by protons at low energy, two nucleon system-the deutron magnetic dipole and electric quadruple moments, non-central forces, p-p and n-n scattering at low energy, charge independence of nuclear forces and concept of iso-spin invariance.

Unit II : Nuclear Models and Fission

(i) Emperical evidence for the regularity of nuclear properties-nuclear mass and binding energy, magic numbers. The single particle shell model-the average shell model potential. Multipole fields, the electromagnetic matrix elements, life time-energy relations, the Weisskopf formula of transition rate, nuclear isomerism, internal conversion. Zero-zero transitions.

(ii) Fission-Discovery of fission, Theory of fission, Energy release, criticality of a Reactor and four factor formula, types of fuels and types of reactors, Breader React or, Neutron cycle in a thermal Nuclear Reactor.

Unit III : Nuclear Interaction

(i) Weak interactions : nuclear beta decay, the neutrino, electron capture experimental information, Fermi and Gammow Teller transitions, Fermi Theory, selection rules (non-relativistic case only). Mass of neutrino, parity violation.

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(ii)   The strong interaction: strength of strong interaction, nuclear and particle resonances i.e. introduction of resonance states in high energy particle interactions. Alpha decay and barrier penetration and related experimental information. Selection rules of strong interaction. Introduction of SU (3) symmetry.

Unit IV : Introduction of Particles and Conservation Laws

Introduction of Electron, alpha particles, photon, positron, neutron neutrino and the muons. Baryons and leptons.

Discovery of pion and its characteristics, deltas, Stangeness and kaons etc, lambda and other hyperons. Introduction of charge conjugation, space parity and Gellman Nishijima Scheme. Patron, quark- model-quark and gluons, quark composition of baryons and mesons J/Ψ particle, W and Z-particles and Higgs. Emphasis should be given on experimental discoveries and conservation laws while introducing the particles and resonances.

Unit V : Passage of radiation in matter

(i) The interaction of neutron and gamma-radiation with matter : related effects and Laws, passage of charged particles through matter, energy loss by collision, energy loss by radiative processes, absorption of electromagnetic radiation. Experimental Studies-Multipole coulomb scattering, range-energy curve straggling, capture and loss, stopping power for heavy ions, concept of radiation safety.

(ii)   Nuclear techniques-Tandem, electrostatic generator Linear accelerators-drift tube accelurators, orbital accelerators-cyclotrons, the Synchro cyclotron, Bending and Focussing magnets-The magnetic spectrometer. Production of high energy neutrons.

Detectors-Ionization Chamber technique, G.M. Counter, scintillation detector, Emulsions, neutron detectors.

In general the scope of the syllabus is defined by Chapters 5, 6 and 7 for unit I and II Chapters 2, 3 and 4 for unit V and by Chapters 9, 10 and 11 for unit III and IV of the book entitled "Elements of Nuclear Physics" by W.E. Burcham published by Longman 1979.

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The related examples given at the end of aforesaid chapters of book by Burcham may be done as illustrative exercises for practice. *Further books suggested for reference :*

1. Nuclear Physics : Irving Kaplan
2. Concepts of Nuclear Physics : B.L. Cohen
3. Introductory Nuclear Physics : Kenneth S. Krane
4. Introduction to Nuclear Physics; CMH. Smith
5. Nuclear Physics, S.N. Ghoshal
6. Introduction to High Energy Physics, Perkins.

Paper-XI : Physics of Materials

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

Unit-I

Introduction : Materials Science and engineering, classification of engineering materials, levels of structure, structure-property relationships in materials.

Crystal Geometry and Structure Determination : Space lattices, Space lattices and crystal structures, Crystal directions and planes, Bragg's law of X-ray diffraction, Powder method, structure determination. Extinction rules for cubic crystals.

Structure of Solids : Crystalline and non-crystalline states, Discussion of solidification and crystallization, glass transition.

Polymers : Classification of polymers, structure of long chain polymers, crystallinity of long chain polymers.

Unit-II

Chemical Bonding in Solids : Bond energy, bond type and bond length, Ionic bonding, Calculation of lattice energy of ionic crystals. Madelung constant, covalent bonding, Metallic bonding, Secondary bonding, Variation in bonding character and properties.

Phase diagrams : Covalent solids, Metals and alloys, Ionic solids. Phase rule, Single component systems, Binary phase diagrams, Level rule.

Unit-III

Band Theory of Solids : Formation of bands (qualitative discussion), Electrons in a period field of a crystal (Krong-Penney Model), Brillouis zones, number of states in a band, Bloch Theorem and Bloch function,

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Dispersion relation inside a band, band shapes, effective mass of an electron, Distinction between metals, insulators and intrinsic semi-conductors.

Lattice Vibration and Thermal Properties of Solids : Lattice vibrations, Linear monoatomic and diatomic chains, Acoustic and Optical photons, Normal modes, Spectral distribution function, Einstein and Debye Theories of specific heat solids, contribution from electron gas in metals, Thermal conductivity of metals.

Unit-IV

Electrical conductivity : Equilibrium state of electron gas in a conductor in the absence of electric field, electron drift in an electric field, relaxation time and mean free path, electrical conductivity of electron gas, Wiedmann-Franz law, Temperature dependence of electrical conductivity of pure metal. Hall effect and determination of density and mobility of charge carriers in semi conducting materials.

Dielectric Properties : Polarization, Temperature and frequency effect. Electric break down, classical theory of electronic polarizability, Normal and anomalous dispersion, Complex dielectric constant and loss, Ferroelectric materials, Measurement of dielectric constant and loss. P-E hysteresis loop in ferroelectricity.

Qualitative discussion of pyroelectric and piezoelectricity.

Unit-V

Magnetic Properties : Response of substances to magnetic field, dia, para and ferri and ferromagnetic materials. Magnetic moment of atom, orbital part, spin part and total magnetic moment, Langevin's theory of dia-and paramagnetism. Ferromagnetism and related phenomena, domain structure, hysteresis loops. Measurement of magnetic permeability and B.H. hysteresis Soft and hard materials.

Superconductivity : Introduction, Survey of superconductivity. Mechanism of superconductivity, Effect of magnetic field, Meissner effect, Type I and Type II superconductors, Thermal conductivity, Penetration depth. Energy gap and specific heat, Isotope effect, application of superconductivity.

Reference Books :

1. Materials Science and Engineering by V. Raghavan, Prentice-Hall Edition 1993.

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2. Solid State Electronic Engineering Materials by S.O. Pillai, Wiley Eastern Ltd.
3. Solid state Physics by C. Kittel V. Edition.
4. Introduction to Solid by L. Azaroff.
5. Solid State Physics by N.W. Aschroft and N.D. Mermin CBS Publishing Asia Ltd.

Paper-XII : Atomic and Molecular Physics

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

Unit-I : Monovalent and Divalent Atoms

Background from quantum theory : The four quantum numbers; spectral terms arising from L-S coupling, s,p,d,f notation, Matrix elements of dipole moment selection rules, emission and absorption probabilities, Half life of excited states; width of a spectral line-natural, Doppler and others, Spectra of mono and divalent atoms; Doublet fine structure of hydrogen lines; screening constants for monovalent atoms, series limits, doublet structure of alkali spectrum, spectra of helium and alkaline earth atoms, singlet and triplet series, Isotope effect and deduction of m/M from hydrogen and deuterium spectra.

Unit-II : Magnetic Field effects and x-ray spectroscopy

Effect of magnetic field on energy levels: Gyromagnetic ratios for orbital and spin moments; vector model, J-J coupling, Lande g factor, strong and weak field effects, illustrative cases of H, Na, Ca, and Hg, X-ray spectra : The continuous X-ray spectrum; Daune and Hunt limit. Characteristic X-rays; Moseley's law, doublet fine structure, H-like character of X-ray energy states, X-ray absorption spectra, absorption edges. Qualitative discussion of near edge and extended fine structure; determination of atomic number of atoms.

Unit-III : Diatomic Molecules

Sharing of electrons, formation of molecular orbitals, qualitative discussion of H_2 ion, H_2 molecule, Electronic levels and quantum numbers for electronic states of diatomic molecules: singlet and triplet,

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characters. Ratational energy levels, internuclear distance, Vibrational energy levels, force constants, anharmonicity, dissociation energy, isotope effect on rotational and vibration energies. Spectra of diatomic molecules : Pure rotation spectra: selection rules. Vibration rotation spectra: selection rules, P, Q, and R branches, Electronic band system, sequences and progressions, Franck-Condon principle.

Unit-IV : Triatomic Molecules

Triatomic molecules : Normal modes of a triatomic molecule; selection rules for infrared absorption, Raman effect : Raman shifts, Strokes and anti-strokes lines, selection rules in Raman spectra. The structure of H_2O, CO_2 and N_2O Molecules from IR and Raman spectra, Laser as intense source for Raman excitation.

Unit-V : Experimental Techniques

Emission spectroscopy : Emission sources, prism grating and crystal spectrographs, Prism material useful for UV, V and IR regions, constant deviation systems. Concave grating, different types of mountings, monochromators, resolution and dispersion in various spectrographs, high resolution spectroscopy, Febry-Perot and Lummer plate in high resolution.

Absorption spectroscopy : Continuous sources for absorption studies in X-ray, UV, V and IR region, single-beam and double-beam instruments, detection systems-photographic plate, photomultiplier tube, bolometer. Laser techniques : Laser imaging of objects, burnable lasers for high resolution spectroscopy, pulsed lasers for time resolved spectroscopy.

Reference Books :

1. G. Herzberg; "Atomic Spectra and atomic structure".
2. H. Kuhn : "Atomic Spectra".
3. Walker and Straugha, "Spectroscopy, Vol. I, II, III."
4. H. Herzberg; "Molecular Spectra and Molecular structure."
5. H. Barrow : "Theory of Atomic Spectra."
6. R.C. Johnson : "Introduction to Molecular Spectra."
7. White; "Atomic Spectra".
8. B.K. Agrawal : "X-ray Spectroscopy."
9. D.P. Khandelwal : "Optics and Atomic Physics."

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List of Physics Practicals

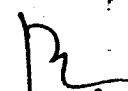Max. Marks : 100   Min. Pass Mark : 40

Duration : Two Practicals of five hours duration each spread over two days.

The students are expected to perform 15 experiment in academic session, the suggested list of experiments is given below. The institution may, however, set other experiments of the equivalent level and may communicate the same to the Convener. Board of Studies.

1. Determination of Planck constant by photo cell (retarding potential method using optical filter, preferably five filters).
2. Determination of Planck's Constant using solar cell.
3. Determination of Stefan's Constant (B-B method).
4. Study of Iodine spectrum with the help of grating and spectrometer and ordinary bulb light.
5. To find the magnetic susceptibility of a paramagnetic solution using Quincke's method. Also find the ionic molecular susceptibility of the ion and magnetic moment of the ion in terms of Bohr magnetrons.
6. Study of polarization by reflection form a glass plate with the help of Nicol Prism, and photo cell and verification of Brewster's Malu's law.
7. e/m measurement by Helical method.
8. Measurement of electric change by Millikan's oil drop method.
9. Study of the characteristic of a GM counter and verification of inverse square law for the same strength of radio active source.
10. Study of random process and statistical distribution using GM counter.
11. Study of β-absorption in Al foil using GM counter.
12. Study of gamma ray spectra using scintillation spectra meter.
13. Study of Bremsstrahlung by electrons of 100 KeV to 2 MeV energy using scintillation spectrometer.
14. Scintillation spectroscopy of Beta radiation.
15. Study of excitation of characteristic X-rays by electron.
16. Study of X-ray absorption with GM counter.
17. Study of parametric amplifier.
18. Study of normal modes and dispersion relation in a beaded string.

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2. CHEMISTRY

Paper-IX Inorganic Chemistry
(4 hrs. / Week)

Unit-I

Metal-Ligand bonding:

(a) Limitations of crystal field theory, molecular orbital theory of octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory.

(b) Organometallic Compounds: definition and classification of organometallic compounds, synthesis, properties and structures of organometallic compounds of magnesium, aluminium, tin and lead.

(c) Metal Carbonyls: preparation, properties and bonding of transition metal carbonyls. Detailed study of mononuclear and polynuclear carbonyls.

Unit-II

Inorganic Polymers:

(a) Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones, phosphonitrillic halides and condensed phosphates.

(b) Metal Clusters: Higher boranes, carboranes, metalloboranes and metallocarboranes, metal carbonyl and halide clusters, compounds with metal-metal multiple bonds.

Unit-III

Nuclear Chemistry:

(a) Fundamental particles of nucleus (nucleon), concept of nuclides, Representation of nuclides, isotopes, isobars and isotones with specific examples. Applications of radioisotopes, size concept in nucleus and atom. Qualitative idea of the stability of nucleus (n/p ratio).

(b) Nuclear Chemistry-II: Shell and liquid drop model, natural and artificial radioactivity, disintegration series, disintegration rates, half life, average life, nuclear binding energy, mass defects, Einstein's mass energy relations, artificial transmutation, nuclear reactions, spallations, nuclear fission and fusion, nuclear reactors, Hazards of radioactive emanations.

Unit-IV

Bioinorganic Chemistry:

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(a) Role of bulk and trace metal ions in biological systems with special reference to Na, K, Mg, Ca, Fe, Cu and Zn.

(b) Metalloporphyrins: Chlorophylls and their role in photosynthesis. Hemoglobin and Myoglobin and their role as oxygen carriers.

Unit-V

Nitrogen fixation: Mechanism, nitrogenase enzyme, dinitrogen complexes as models for nitrogen fixation.

Metalloenzymes: General discussion of enzymes, functions of metal ions, inhibition (explanation based on coordination chemistry), carboxypeptidase-A and cytochrome-C.

Books Suggested:

1. Manfred Bochmann, Organometallics 1: Complexes with transition Metal-Carbon σ-bonds (Oxford Chemistry Primers).
2. Manfred Bochmann, Organometallics 2: Complexes with transition Metal-carbon π-bonds; (Oxford Chemistry Primers).
3. R.C. Mehrotra and A. Singh, Organometallic Chemistry.
4. ChristophElschenbroich, AlbcrchtSalzer, Organometallics: A Concise Introduction.
5. J.E. Huheey, Inorganic Chemistry.
6. F.A. Cotton and G Wilkinson, Advanced Inorganic Chemistry.
7. D.F. Shriver and P.W. Atkins, Inorganic Chemistry.
8. R. Sarkar and NityanandSaha, General and Inorganic Chemistry (Hon. Consulting Editor).
9. James E. Mark, H.R. Allcock and Robert West, Inorganic Polymers (2nd Edn).
10. M.F. Lappert and G.J. Leigh, Developments in Inorganic Polymer Chemistry.
11. H.J. Arnikar, Essentials of Nuclear Chemistry.
12. G. Friendlander and J.W. Kennedy, Nuclear and Radiochemistry.
13. S. Glasston, A Source Book on Atomic Energy.
14. A.V.S. Rama Rao, A Text Book of Biochemistry.
15. A.C. Deb, Fundamentals of Biochemistry.
16. M.N. Hughes, Inorganic Chemistry of Biological Processes.
17. Smith et.al, Principles of Biochemistry.
18. Christopher K. Mathews, Kensal E. van Holde and Kevin G Ahern, Biochemistry (2nd Edn).

Paper-X: Organic Chemistry
(4 Hrs. / Week)

Unit-I

Heterocyclic Compounds: Nomenclature, Five and Six membered heterocyclic compounds, Aromatic Character, preparation, reactions, chemical reactivity, orientation (Electrophilic and nucleophilic substitution reaction) basicity of pyrrole, furan, thiophene and pyridine. Condensed five and six membered heterocycles, structure, preparation and reactions of indole, quinoline and isoquinoline.

Polynuclear Compounds: Structure of naphthalene, mechanism and orientation of electrophilic substitution in naphthalene, preparation and properties of naphthalene and anthracene, some

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important derivatives of naphthalene, like naphthols and naphthylamines. Preparation and reaction of diphenyl, diphenylmethane and triphenylmethane.

Unit-II

Synthetic Dyes: Color and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo.

Drugs: Chemotherapy, synthetic uses and side effects of:

Analgesics: Aspirin, Phenacetin, Paracetamol.

Antimalarials: Chloroquine, Plasmoquine.

Antibiotics: Chloramphenicol (Chloromycetin).

Sulpha drugs and their mechanism of action, Synthesis of sulphadiazine, sulpfnpyridine, sulphalhiazole, sulphaguanidine and sulphamethazole.

Polymers aad polymerization: Addition and condensation polymerization, their mechanism, copolymerization, coordination polymerization, Ziegler-Natta catalyst, plastics, thermoplastic and thermosetting resins, plasticizers, polystyrene, PVC, polyacrylates, polyacrylonitrile, dacron, terylene, nylon-66, bakelite, melamine and polyurethanes. Elementary idea of the stereochemistry of polymers. Synthetic and natural rubber.

Unit-III

Amino Acids, Peptides and Proteins: Classification, structure and stereochemistry of amino acids, physical properties, zwitter ion structure, isoelectric point and electrophoresis. Preparation and reaction of α-amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins, peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structure of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation.

Nucleic acids: Introduction, constitution of nuclic acids (RNA and DNA). Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Unit-IV

Carbohydrates: Introduction, classification, constitution and reaction of glucose and fructose, mutarotation and its mechanism, cyclic structure, pyranose and furanose forms, Haworth projection formulae, configuration of monosaccharides, determination of ring size, conformational analysis of monosaccharides, Epimerization, chain lengthening and chain shortening in aldoses. Interconversion of aldoses and ketoses.

Disaccharides: Structure determinations of maltose, lactose and sucrose.

Polysaccharides: Structure of starch and cellulose.

Organometallic Compounds: Organomagnesium compounds: The Grignard reagents-formation, structure and chemical reactions.

Organozinc compounds: Formation and chemical reactions.

Organolithium compounds: Formation and chemical reactions.

Unit-V

Mass Spectrometry: Introduction, instrumentation, factors affecting fragmentation, ion analysis, ion abundance, fragmentation modes, mass spectral fragmentation of simple organic compounds:

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alkanes, primary alcohols, aliphatic ketones, aldehydes and carboxylic acids. Types of peak: molecular ion peak, isotopic peak, base peak, metastable peak, doubly charged ion, Mc Lafferty rearrangement, retro Diels-Alder fragmentation, Nitrogen rule.

Reference Books:

1. T.W. Graham Solomons and Craig B. Fryhle; Jolin Wiley and Sons, Organic Chemistry: Seventh Edition, Inc. USA.
2. Robert Thornton Morrison and Robert Neilson Boyd, Organic Chemistry; Sixth Edition, Prentice-Hall of India Pvt. Ltd, New Delhi.
3. Jonathan Clayden, Nick Greeves, Stuart Warren and Peter Wothers; Organic Chemistry; First Edition; Oxford University Press, USA.
4. I.L. Finar; Organic Chemistry Vol I and II; Fifth Edition; Longman Scientific and Technical, Singapore.
5. R.M. Silverstein and F.X. Webster; Spectrometric Identification of Organic Compounds. Sixth Edition; John Wiley and Sons, Inc., Singapore.
6. William Kemp; Application of Spectroscopy; Third Edition; Palgrave Publisher Ltd., New York.
7. P.S. Kalsi; Spectroscopy of Organic Compounds; Sixth Edition; New Age International (P) Ltd. Publishers, New Delhi.

Paper XI: Physical Chemistry

(4 Hrs. / Week)

Unit – I

Quantum Mechanics:

Schrodinger's wave equation for particle in three dimensional box, H-atom, quantum number and their importance, H like wave functions, radial wave functions, angular wave functions. M.O. theory, basic ideas - criteria for forming M.O. from A.O., Construction of M.O.'s by LCAO–H_2^+ ion, calculation of energy levels from wave functions from energy levels from wave functions, physical picture of bonding and anti-bonding wave functions, concept of σ, σ^*, and π, π^* orbitals and their characteristics. Hybrid orbitals- sp, sp^2, sp^3, calculation of co-efficient of A.O.'s used in these hybrid orbitals. Introduction to Valence bond model of H_2, comparison of M.O. and V.B model.

Unit - II

(a) Photochemistry:

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the exited sate, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simplex examples).

(b) Physical Properties and Molecular Structure

Optical activity, polarization (Calusius-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties: paramagnetism, diamagnetism and ferromagnetic.

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Unit – III

Electrochemistry:

Types of reversible electrodes: Gas-metal ion, metal-metal ion, metal-insoluble salt-anion, and redox electrodes, electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential. Standard hydrogen electrode, reference electrodes, electrochemical series and its significance.

Electrolyte and galvanic cells - Reversible and irreversible cells, conventional representation of electrochemical cells. E.M.F. of a cell and its measurements. Computation of cell e.m.f. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), Polarization, Overpotential and Over Voltage. Structure of double layer, theories by Helmholtz, Guoy-Chapman and Stern. Concentration cell with and without transport, liquid-junction potential, application of concentration cells, valency of ions, solubility product and activiy coefficient, potentiometric titrations. Determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Introduction of polarographic technique.

Classification of electrochemical cells, requirement of power source, lead storage cell and fuel cell.

Corrosion: types, theories and method of combating corrosion.

Unit – IV

Macromolecules: Linear branches network and homopolymer. Polymer classification-condensation polymer and addition polymers, number average and weight average, molecular weight determination methods of polymers by (1) osmotic pressure, (2) viscosity, (3) light scattering. Properties of macromolecules.

Chemical Kinetics: The simple catalysis mechanism $S + C \rightarrow SC \rightarrow P + C$. Its mathematical treatment and its consequences. Specific and general acid-base catalysis, enzyme catalysis, surface catalysis and Langmuir adsorption isotherm, mechanism of surface catalysis.

Unit – V

Phase Equilibrium:

Solid solutions: Compound formation with congruent melting point (Mg-Zn) and benzophenone-dimethylamine, incongruent melting point $NaCl-H_2O$, picric acid and benzene, $FeCl_3 – H_2O$ and $CuSO_4 – H_2O$ system.

Liquid-Liquid Mixtures: Ideal liquid mixtures, Raoult's law and Henry's law, non – ideal system, Azeotropes $HCl-H_2O$ and ethanol-water system.

Particularly miscible liquids: Phenol-water, Trimethylamine-water, Nicotine-water system, Lower and upper consulate temperature, effect of impurities on consulate temperature. Immiscible liquids – Steam distillation.

Surface phenomenon, Micelles: surface active agents, classification of surface active agents, micellization, hydrophilic interaction, critical micellar concentration (CMC), factors affecting CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization. Phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

Adsorption: Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (electro kinetic phenomenon), catalytic activity at surface, electrode/electrolyte interface.

Suggested Books:
1. Physical Chemistry by S. Glasston.
2. Micelles: Theoretical and applied aspects YoshikiyoMoroi,Springer Publications.
3. Modern Aspects of Electrochemistry(Vol.I& II), A.K.N.Reddy,Plenum Press,New York.
4. Physical Chemistry,Puri,Sharma and Pathania,Vishal Publication.
5. Physical Chemistry,Behl&Tuli, S.Chand Publication,Delhi.
6. Introduction to Polarographic and Allied Techniques, K Zutshi, New Age International Publication.
7. Introduction to Polymer Science, V.R.Gowariker, N.V.Vishwanathan&J.Shridhar, Wiley Eastern.

Paper XII: Analytical Chemistry
(4 Hrs. / Week)

Unit-I

Electrogravimetry: Theory, electrode reactions, overpotential, completeness of deposition, electrolytic separation of metals, character of the deposit and electrolytic separation of metals with controlled cathode potential. Electrolytic determinations at constant current— Copper and Lead. Electrolytic determinations with controlled cathode potential— Antimony, copper, lead and tin in an alloy.

Coulometry: Coulometry at controlled potential, separation of Ni and Co by coulometric analysis at controlled potential, coulometry at constant current, coulometry titrations.

Unit-II

Polarography: Principle and experimental set-up. Diffusion current and Half-wave potential— Qualitative and quantitative applications of polarography in analytical chemistry.
   (i) Wave height concentration graph.
   (ii) Internal standard (piloton method)
   (iii) Standard addition method.
Use of polarography in: (i) Zn and Cu in brass
                    (ii) Dissolved oxygen in sample.

Amperometry: Amperometric titrations, technique of amperometric titrations with the dropping mercury electrode, titration with the rotating platinum micro electrode, biamperiometric titrations.

Modified Voltammetric methods: Current sampled (TAST) Polarography, Pulse polarography, Differential pulse polarography, Cyclic Voltammetry, Sinusoidal Alternating current polarography, Stripping Voltammetry.

Unit-III

Mass spectrometry: Instrumentation and technique, Elementary idea about electron impact, chemical ionization and matrix assisted laser desorption ionization (MALDI), mass spectrometer techniques. Principle of fragmentation, molecular ion peak, base peak, isotopic peaks and metastable ion peak. Determination of molecular formula, mass spectra of alkanes, alkenes, alkynes, cycloalkanes and arenes, alcohols and ethers, aldehydes and ketones.

Gas Chromatography and HPLC: Introduction, gas chromatographs, detectors, programmed temperature gas chromatography, quantitative analysis by GLC, gas—solid chromatography. High performances liquid chromatographic methods— Adsorption Chromatography. Liquid-

iiquid partition chromatography, Ion exchange, HPLC, exclusion chromatography.

Unit-IV

Diffraction Pattern: Fundamental, principles, instrumentation, use of x-ray, electron and neutron in diffractommetry and applications of x-ray, electron and neutron diffractometry in biological and as analytical techniques. Applications of x-rays in C.T. scan.

Unit-V

Automated Methods of analysis: Automatic instruments and automation. Automation of sampling and preliminary sample treatment for air, water and soil, continuous flow method. Discrete methods, Automatic Anlaysis based on Multilayer Films.

NMR Spectroscopy: Theory of nuclear magnetic resonance, experimental methods of NMR spectroscopy, applications of proton NMR including applications in MRI technique.

Suggested Books:
1. D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry.
2. A.I. Vogel, Analytical Chemistry.
3. H.H. Willard, L.L. Merritt, J.A. Dean and F.A. Settle, Instrumental Methods of Analysis.
4. G.R. Chatwal and S.K. Anand, Instrumental Methods of Chemical Analysis.
5. I.M. Kollthop, Analytical Chemistry.

B.Sc.(HONS.) PART-III CHEMISTRYPRACTICALS
(8 hrs or 12 periods /week) (Spread in four days)

INORGANIC CHEMISTRY

1. Qualitative analysis of mixture containing six radicals one of which should be a rare ion. The mixture may contain radicals of any combination including interfering acid radicals and insolubles.

2. Quantitative estimation of *any three* of the following mixture by volumetric andgravimetric methods.
   a) Copper-Zinc
   b) Zinc-Nickel
   c) Silver-Copper
   d) Silver-Nickel
   e) Silver-Zinc
   f) Copper-Nickel

3. Inorganic Preparations and its characterization (*any four*) and characterization of coordination compounds:
   a) Bis (dimethylglyoximato) nickel (II) complex
   b) Tetraamminecopper (II) sulphate
   c) Potassium cis-diaquabis(oxalato)chromate (III) dihydrate
   d) Hexamminenickel (II) chloride
   e) Perssian blue
   f) Chloropentaamminecobalt (III) chloride
   g) Carbonatotetraamminecobalt (III) nitrate

4. Analysis of (*any three*) of the following
   a) Available chlorine in bleaching powder.

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b) Water analysis for total hardness.
c) Analysis of two components.
d) Analysis of cement for Ca, Al or Mg.
e) MnO_2 in pyrolusite.

ORGANIC CHEMISTRY

1. **Quantitative Estimations**
   a) Determination of neutralization equivalent of an organic acid.
   b) Determination of Saponification value of an ester/oil.
   c) Estimation of glucose by titration with Fehling's solution/ Benedict solution.

2. **Qualitative analysis**
   Analysis of an organic mixture containing two solid components using water, $NaHCO_3$ and NaOH for separation and preparation of suitable derivatives.

3. **Two step preparations of simple compounds**-the students are expected to perform at least three of the following preparations.
   a) Preparation of p-aminoazobenzene from aniline.
   b) Preparation of p-nitroaniline from acetanilide.
   c) Preparation of syn-tribromobenzene from aniline.
   d) Preparation of m-nitroaniline from nitrobenzene.
   e) Preparation of acetanilide from acetophenone (Beckmann rearrangement).
   f) Preparation of anthranilic acid from phthalic anhydride.
   g) Preparation of eosin from phthalic anhydride.

PHYSICAL CHEMISTRY

(A) **Potentiometry (Multimeters may be used)**
   1. To find out the strength of acid by titrating it against alkali.
   2. Determination of dissociation constant of weak acids.
   3. Determination of number of electrons involved in a cell reaction by setting up a concentration cell.
   4. Determination of transport number of anion by e.m.f. measurements.

(B) **pH metric titrations:**
   1. To find out the strength of strong acid by titrating it against strong base.
   2. To find out the strength of strong acid by titrating it against weak base.
   3. To find out the strength of weak acid by titrating it against strong base.
   4. Find out the strength of HCl and CH_3COOH in a mixture of both by titrating it against NaOH.

(C) **Spectrophotometer experiment or Colourimetric experiment**
   a) Verify Lambert Beer Law & determine the concentration of the given aqueous solution of unknown concentration of salt.

(D) **Kinetics:**
   1. Determine the effect of ionic strength on the rate of persulphate iodide reaction.
   2. Determination of molecular weight by Rast Camphor method.
   3. Determination of concentration of given solution of H_2SO_4 acid by measuring heat changes during dilution.
   4. Compare cleaning power of two samples of detergents by surface tension measurement.

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B.Sc. (HONS) Pt.-III CHEMISTRY PRACTICAL EXAMINATION

Max. Marks: 100   **Duration of Exam: 10 hrs.**   **(Complete in Two days)**

1. Qualitative analysis of inorganic mixture for six radicals (including interfering, rare and insolubles)

   OR

   Inorganic preparations

2. Quantitative estimations (gravimetric and volumetric).   15
3. Separation and identification of two compounds in the given organic mixture and preparation of their suitable derivative.   15

   OR

   Organic two step preparations.

4. Quantitative estimations·   15
5. Physical Chemistry   10
   (a) Perform one major exercise
   (b) Perform one minor exercise   15
6. Record   10
7. Viva-voce   10
                                              10

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3. Zoology

Scheme of Examination

Max. Marks: 50

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

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

Paper XIII: Ecology

Section - A

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: O_2, CO_2 H_2O, N & P and role of microbes.

Section - B

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

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

Section - C

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

Section - D

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

Paper-XIV: Environmental Biology

Section – A

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

Section - B

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

Section - C

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

Section - D

9. Wild life conservation: Vanishing and threatened animals and plants with special reference to Rajasthan, wild life management efforts by government and non government organizations.
10. 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.

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11. Space ecology: Space problems and their solutions, space ecosystem and space colonization.
12. Sustainable environment.

Paper-XV: Development Biology

Section - A

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

Section - B

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

Section - C

7. Organogenesis of heart, kidney, nervous system and sense organs.
8. Post-embryonic developments: Insects and amphibians.
9. Regeneration in invertebrates and vertebrates.

Section - D

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

Paper-XVI: Evolution

Section - A

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

Section - B

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

Section - C

8. Adaptations: Mimicry.
9. Polymorphism: Population genetics, genetic drift and Hardy-Weinberg law.
10. Macro- and micro-evolution, evolution of man.

Section - D

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

Paper-XVIII: Applied Zoology-1

Section - A

1. The scope and history of microbiology.
2. Major characteristics of microorganisms.
3. Microbial classification, nomenclature and identification.

Section - B

4. Bacteria: Morphology, fine structure, cultivation, reproduction & growth, pure culture and characteristics.
5. Bacterial nucleic acids.

Section - C

6. 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*).
7. Microorganisms: General characteristics of fungi (molds and yeast), algae, protozoa and viruses.
8. Medical Zoology: Role of normal flora, Normal flora as pathogens, brief introduction to pathogenic microbes, viruses (Pox virus, Herpes virus, Adenovirus, Hepatitis virus, HIV & AIDS virus), rickettsia, spirochetes, staphylococcus, streptococcus, pneumococcus, haemophilus, *Mycobacterium tuberculosis* and clostridium.

Section - D

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

Paper-XVIII: Applied Zoology-2

Section - A

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.

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-'. 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.

Section - B

5. Protoplast fusion in prokaryotes and eukaryotes.
6. Clonong 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.

Section - C

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

Section - D

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

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

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

Practicals

I. **Analysis of environmental components**
   1. Soil pH.
   2. Water analysis: pH, alkalinity, acidity dissolved oxygen, free CO_2 and salinity (chlorides).
   3. Study of phyto-and –zoo-planktons in the given water sample.
   4. Quatitative estimation of zooplanktons in the given water sample
   5. Simple methods to measure population density.
   6. Field study of any one of the following habitats: Freshwater/lake/pond/ river or desert.

II. **Development Biology** (with the help of models /charts/CD-ROM's/ high resolution picture/video's etc.)
   Study of frog/toad development:
   1. Egg, cleavage, blastula, gastrula, neurala, tail bud, mature tadpole larva, metamorphic stages and froglet/toadlet.

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2. Histological slides: Cleavage, blastula, gastrula, neurula and tail bud.
3. Study of living tadpole larva and its metamorphosis.

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

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

IV. Applied Zoology-1
1. Preparation and use of culture media for microbes.
2. Study of microbes in food material (curd and milk).
3. Preparation of bacterial culture (water, air, soil/sludge)-Spread plate and streaking method.
4. 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.
5. Preparation of culture media for fungus and its identification.
6. Study of microscopic slides: *Entamoeba, Trypanosoma, Leishmania, Plasmodium, Wucheria* and *Dracunculus.*
7. Visit to Dairy/wine processing unit. Submit a report.

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.) Part-III

Scheme of practical examination and Distribution of marks

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

Min. marks: 40
Ist day

Max. marks :100
Regular

1.	Environmental Biology	10
2.	Biotechnology (Applied Zoology)	10/15
	(Marks of the observation and result=05 to be Given the next day if required)	
3.	Evolution	10
4.	Viva voce	05
5.	Class Record	05
6.	Seminar/Project Report/Collection	05

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1.	Development Biology	09
2.	Biotechnology	05
	(Observations and results of the Ist 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.
2. Balinsky B. I. and Fabain 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. 24th edition Mc Graw Hill Education India Pvt. Ltd. 2012
10. Giese A. C: Cell Physiology. 4th 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. 11th revised edition, Rastogi Publications 2014.
17. Lehninger AL: Biochemistry. Kalyani Publishers. 2008.
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.

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22. Old RW and Primrose SB: Principles of Gene Manipulation: An Introduction to Genetic Engineering. University of California 1980.
23. Primrose S. B. and Twyman R. M: Principles of Gene Manipulation and Genomics. John Wiley & Sons, 2013.
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. Ltd. 1997.
26. Rao KV: Development Biology: A Modern Synthesis. Oxford and IBH Publishing. 1994.
27. Rastogi VB: Animal Distribution, Evolution and Development Biology. Kedar Nath Ram Nath Educatioal Publishers.
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. 12th revised edition, Rastogi Publications 2014-2015.
31. Verma PS and Agarwal VK: Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. 14th edition, S. Chand 2004.
32. Verma PS and Agarwal VK: Chordate Embrylogy: Development Biology. S. Chand & Company Ltd. 2012.
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.

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4. BOTANY

B.Sc. Part I (Hons.)

Maximum Marks: 400   **Min. Pass Marks: 160**

- Paper-I Cytology, Genetics and Plant Breeding   75marks
- Paper- II Algae, Fungi and Bryophyta   75marks
- Paper-III Plant Physiology and Biochemistry   75marks
- Paper-IV Ecology and environmental science   75marks
  Practical (6 hrs.)   100marks

B.Sc. Part II (Hons.)
Maximum Marks: 400
                                                         Min. Pass Marks: 160

I. Paper- Molecular biology   75marks
II. Paper- Pteridophyta, Gymnosperm and Paleobotany   75marks
III. Paper- Morphology and Anatomy of angiosperms   75marks
Paper- Microbiology and plant pathology   75marks
Practical (6 hrs.)   100marks

B.Sc. Part III (Hons.)
Maximum Marks: 400
                                                         Min. Pass Marks: 160

- Paper- Plant Biotechnology
- Paper- Systematics of angiosperms   75marks
- Paper- Plant utilization and Ethanobotany   75marks
- Paper- Embryology of angiosperms and Seed science   75marks
  Practical (6 hrs.)   75marks
                                                         100marks

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IX – PAPER L Plant Biotechnology

UNIT I

Plant Tissue culture

Historical perspective; composition of media; nutrient and hormone requirement;methods of sterilization; totipotency; concept of differentiation,dedifferentiation and redifferentiation; physical-chemical conditions for propagation of plant cells and tissues; Plant regeneration routes: micropropagation,organogenesis and somatic embryogenesis; Anther culture,production of androgenic haploids;protoplast isolation culture and fusion;somatic hybrids & cybrids .Application of Plant Tissue culture .

UNIT II

Recombinant DNA Technology

Introduction, Restriction endonucleases (history, types and role); Other enzymes, Cloning vectors plasmids , bacteriophages ,cosmids.Introduction of recombinant DNA into host cells, methods for identification of recombinants, Gel Electrophoresis. PCR; DNA Sequencing (Sanger's method and Maxam Gilbert's method); Southern, Northern and Western blotting; construction of genomic and cDNA library; Introduction to Bioinformatics.

UNIT III

Plant Transformation Technology

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Obtaining gene of interest by different methods; Gene constructs; Gene transfer methods; *Agrobacterium*-mediated transformation; Direct gene transfer methods– Electroporation Microinjection, Gene-gun; Selection of transgenics - marker and reporter genes

Role of Plant Biotechnology in Agriculture, Environment and Industry

Pest resistant plants (Bt-cotton); herbicide resistance; disease and stress resistant plants; transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Plants as bioreactors. Biosafety regulations in India.

Suggested laboratory exercises:

1 Preparation of media MS (1962)

2 Aseptic culture of different explants, methods of in vitro sterilization, inoculation and subculture methods

3 Study of Gene engineering Techniques (photographs): PCR , DNA Fingerprinting, DNA Sequencing , Gene gun, Ti plasmid.

4 Demonstration of Southern, Northern and Western Blotting(Photographs)

5 Study of steps of genetic engineering techniques from photographs (Bt cotton, Golden rice, Flavr Savr tomato)

6. Demonstration of technique of Gel Electrophoresis

7. Protoplast Isolation by Enzymatic method.

8. Restriction Digestion of DNA

SUGGESTED READINGS

1 Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.

2 Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.

3 Chrispeel. and Sadava. D.E. 1994 Plants, Genes and Agriculture. Jones and Barlett Publishers.

4 Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.

5 Smith, R 2008 Plant Tissue Culture: Techniques and Experiments, 2nd edition, Academic

6. Gardner. E.J. Simmonns, M.J. Snustad, D.P. 2008 8th edition Principles of Genetics. Wiley India.

7 Russell. P.J. 1998 Genetics A Molecular Approach. 3rd edition. Benjamin Co.

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8 Raven, P.H. ...rson, GB., Losos, J.B. and Singer, S.R. 2005 Biology. Tata MC Graw Hill

9. Brown, T. \ ...ne cloning and DNA analysis: An Introduction. Blackwell Publication.

10. Sambrook & Russel. Molecular Cloning: A laboratory manual. (3rd edition)

X Paper   Systematics of Angiosperms

Unit I

Taxonomy: introduction, definition, components.

Herbarium specimen preparation, methods and importance.

Important herba ... (National, international and digital herbaria).

Taxonomic literature- botanical gardens, monograph, icones, manuals, journals, abstracts, indic... ...d library

Keys construct... with their types for plant identification.

Taxonomic nich ...hy, taxonomic categories, concept of species, genus and family.

ICBN: Princip.. ...nd rules of nomenclature; nomenclature of hybrids and cultivars.

Phylogeny of angiosperms: Time and place of origin and evolution of angiosperms; primitive living angiosperms.

Unit II

Types of classification – Linnaeus, Benthum and Hooker, Engler and Prantl, Thakhajan and APG.

Tools of taxonomy - anatomy, embryology, palynology, ecology, cytology and chemotaxonomy.

Numerical taxonomy - concept, characters, OTU's, coding, cluster analysis and cladistics.

Unit III

Diversity of flowering plants illustrated by members and economic importance of the following families: Ranunculaceae, Brassicaceae, Papaveraceae, Malvaceae,

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Fabaceae, Caryophyllaceae Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Asclepiadaceae Convolvulaceae, Solanaceae, Acanthaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Liliaceae, Arecaceae and Poaceae.

Suggested laboratory exercises:

Systematics of Angiosperms
Description of the locally available species of the following families & genera.

- Ranunculaceae: *Ranunculus, Delphinium.*
- Brassicaceae : *Brassica, Alyssum, Iberis, Coronopus*
- Capparidaceae : *Capparis, Cleome*
- Caryophyllaceae : *Dianthus, Stellaria, Spergula.*
- Rutaceae *Citrus, Murraya.*
- Fabaceae Faboideae : *Lathyrus, Clitoria, Melilotus, Cajanus*
  Caesalpiniopideae : *Cassia, Caesalpinia*
  Mimosoideae : *Prosopis, Mimosa, Acacia*
- Myrtaceae *Callistemon, Eucalyptus.*
- Cucurbitaceae *Luffa, Coccinia.*
- Apiaceae : *Coriandrum, Anethum.*
- Rubiaceae *Hamelia, Mussaenda.*
- Asteraceae *Tridax, Helianthus, Calendula, Ageratum, Sonchus, Launaea*
- Apocyanaceae : *Thevetia, Nerium, Tabernaemontana*
- Asclepiadaceae : *Calotropi, Asclepias*
- Solanaceae. *Solanum.*
- Acanthaceae : *Adhatoda*
- Lamiaceae *Ocimum*
- Euphorbiaceae *Euphorbia, Pyllanthus. Jatropha.*
- Liliaceae *Asphodelus Asparagus.*
- Poaceae *Triticum, Hordeum, Poa.*

* Visit a local Botanical garden / Herbarium / national Park / study of local floral biodiversity (candidates are expected to submit a detailed report of such visit).

Suggested Readings:

- Taxonomy of Angiosperms-V.N. Nair (1995) IMH Publishing Company New Delhi

- Introduction to Principles of Plant Taxonomy V.V. Sivarajan (1984) Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

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- Plant [...]-Sushella M.Das (2003) Dominant Publishers and Distribu[...] New D[..]hi
- Plant s[...] G[..] charan Singh (2001) Oxford and IBH Publishing Co. P[..] Ltd., New De
- Trivedi. [...] N. Sharma and J.L. Sharma (2003) Structure, Development and Reproduction [...]werine Plants. Ramesh Book Depot, Jaipur.
- Bhojwa[...] S S and Bhatnagar, S.P. (2000) The embryology of Angiosperms 4th Edition [...] Publishing House, New Delhi.
- An Introduction to the Embryology of Angiosperm. Maheshwari, P.(1950) New Delhi
- [...] es in the Embryology of Angiosperms. Ed. Maheshwirari, P.(1 [...] New .

Paper - Plant utilization and Ethnobotany

UNIT-I

A general ac[...] of plants: Primary and secondary centers of diversity plant introduction [...]eneral account of wheat, rice, maize, sorghum, bajra, sweet potato [...] sugarcane. Legumes; Chickpea (Bengal gram), red gram (arhar) black [...] and fodder legumes;barseem. alhagi ,vegetable plants; potato, tomat[...] cluster been.

UNIT-II

Vegetable [...] Mus[...]rd, groundnut. soybean and coconut a brief account.

Plant fibers [...] ate [...] coir.

Timber and [...] species: A general account distribution and uses of shishum, baboo!

Brever[...] [...] tea

UNIT-III

(34)

Medicinal plants: A brief account of ten important plant drugs and their chief constituents used in indigenous and allopathic system of medicine.with special reference to *Azadirecta indica*, *Emblica officinalis*, *Aloe vera*, *Ocimum sanctum*, *Ravulfia serpentina*, *Linum usea*, *Datura stramonium*, *Withania somnifera*, *Curcuma longa*. Natural rubber (*Hevea brasiliensis*), *Ficus elastica*. Essential oil, dyes - a concise account. Ornamental plants Familiarity with seasonals and perennials grown in your locality.

Suggested laboratory exercises:

Economic botany

- World Map of Vavilon's Centres of origin of cultivated plants and Zhukovskys concept of megacentre.
- Study of starch grains in wheat and potato.
- Cereals: wheat, rice, maize, sorghum, bajra.
- Legumes Chickpea (sengal gram), red gram (arhar),black gram .
- vegetable land po, tomato,round gourd,cluster been.
- Sudan III test for groundnut and coconut oil Rajasthan.
- Economic Botany Spices, Beverage (Tea & Coffee), Sugar,Oil Seeds (Mustard Groundnut.
- Medicinal plants- *A. directa indica*, *Emblica officinalis*, *Aloe vera*, *Ocimum sanctum*, *Ravulfia serpentina*, *Datura stramonium*, *Withania somnifera*,.

Suggested Books:

1. Ambammurthy. A.B.S S. and Subramanyam, N.S. 1989. A textbook of economic botany. Wiley Eastern Ltd., New Delhi.
2. Sharma O.P. 1996. Hills economic botany. Tata McGrawhill Publishing Company Ltd. New Delhi.
3. Simpson B.B. and Conner- Ogorzaly, M.1986 Economic botany- ears in world McGrawhill New York.
4. e.... and Sus. N.1 M 1989, Patterns in plant development ... imbridge University Press, Cambridge.
5. pp. O. i Stem. N.1. 1977 Humanistic Macmillan India. Ltd. New Del.

XII - Paper- **Embryology of angiosperms and Seed science**

UNIT-I

(36)

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

Structure of pistil ovule megasporogenesis, development of embryo sac (female gametophyte).

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

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

UNIT-II

Morphology and anatomy of seed: Development and structure in dicotyledons and monocotyledon (Fabaceae and Poaceae). exomorphic features, gross internal morphology and seed coat anatomy.

Physiology of seed Dormancy—significance. types and release of dormancy: Longevity—life span of seed and factors affecting longevity.

Seed testing procedures Introduction, History of Seed Technology, Aims and importance of seed testing. sampling- types of samples, sampling equipments, methods of testing physical purity and genetic purity (seedling and plant stages). moisture content (oven method, moisture meter). Germination-TTC test, embryo excise method blotter method, roll towel sand or pot experiment; seeding evaluation.

UNIT-III

Seed storage principles and methods of safe seed storage. types of storage structures. deterioration storage and its control.

Seed Health: seed-borne inoculum of pathogens; location of seed-borne inoculum. Methods of seed health testing (Dry seed examination, seed washing test. incubation method and embryo container's method).

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Seed Certification: Concept, minimum certification standards, general and crop standards, Field inspection and ISTA certificates.
The seeds Act of India, National Seeds Corporation, State Seed Corporation, Central Seed Testing Laboratory.

Suggested laboratory exercises:

Embryology

- T.S. of m. rosporangia.
- Types of ovules and placentation.
- Pollen germination and viability.
- Seed germination and seed viability in monocot and dicot plants.
- Diversity in structure of stigma and style.
- Different stages of Embryo-*Raphanus sativus*.
- Monocot and dicot embryo dissection and study of its structure.

Seed science

- Biochemical test of Carbohydrates, Protein and Lipids.
- Study of seed surface microflora of different seeds (wheat, sorghum, bajra and mung).
- Seed viability test (TTC test).
- Calculate seed purity percentage.
- Study seed coat anatomy of different seeds (*Cicer*, pea and maize).
- ISTA certificates.
- Seed health testing by different methods.

Suggested Readings:

- Agar K. and Sinclair. J.B. (1987).Principles of Seed-pathology, II edition Publishers Boca Raton, New York, London.
- Agraw (1980). Seed Technology. Oxford and IBH Publishing Co. Pvt. l New Delhi.

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3. Anonymous (1985 2014). International rules for seed testing. International Seed Testing Association (ISTA). http://www.seedtest.org/en/home.html; http://www.seedtest.org/en/international-rules-_content---1--1083.html

Bewley, D and Black, M. 1983. Physiology and Biochemistry of Seeds in Relation to Germination. Volume I & II. Springer-Verlag, Berlin, Heidelberg, New York.

5. Copeland, L O. 1976. Principles of Seed Sci. and Technology Minnesota, USA

6. Khare, D and Bhale, M.S. (2014). Seed Technology. Scientific Publishers (India), Judhpur Revised 2nd Ed.

7. Kulkarni. G N. 2002. Principles of Seed Technology. Kalyani Publishers, New Delhi.

8. Neergaard, P. 1986. Seed- A horse of hunger or a source of life. Revised print Danish Government Institute of Seed Pathology for Developing Countries, Hellerup, Denmark.

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MATHEMATICS
B.A./B.Sc. (Hons) Part –III – 2019

Teaching : 3 Hours per Week per Theory Paper.
2 Hours per Week for Practical Paper.
Examination:

	Min.Pass Marks			Max. Marks
Scheme:	Science – 160			400
			Duration	**Max.Marks**
Paper – IX	Algebra		3 hrs.	85
Paper – X	Complex Analysis		3 hrs.	85
Paper – XI	Mechanics		3 hrs.	85
Paper – XII	**Any one of the following**			
1.	Statistics		3 hrs.	85
2.	Integral Equations and Calculus of Variations		3 hrs.	85
3.	Calculus of Several Variables		3 hrs.	85
Practical:	Computer Programming in C		2 hrs.	60

Note:

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

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

3. An Internal/external examiner can conduct Practical Examination not more than 100 (**Hundred**) candidates.

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

Paper -IX : Algebra
Teaching : 3 Hours per Week
Duration of Examination : 3 Hours   **Max. Marks: 85**

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Definition and simple properties of Groups and Subgroups. Permutation group, Cyclic group. Cosets, Lagrange's theorem on the order of subgroups of a finite order group.

Unit 2: Morphism of groups, Cayley's theorem. Normal subgroups and Quotient groups. Fundamental theorems of Isomorphism.

Unit 3: Definition and simple properties of Rings and Subrings. Morphism of rings. Embedding of a ring, Integral domain and field. Characteristics of a Ring and Field.

Unit 4: Ideals and Quotient Ring. Maximal ideal and Prime ideal. Principal Ideal domain. Field of quotients of an integral domain. Prime fields. Definition, Examples and Simple properties of Vector spaces and Subspaces.

Unit 5: Linear combination, Linear dependence and Linear independence of vectors. Basis and Dimension. Generation of subspaces. Sum of subspaces. Direct sum and Complement of subspaces. Quotient space and its dimension.

I.

Reference Books:
1. N.S.Gopalkrishnan, University Algebra, New Age International, 1986.
2. Qazi Zameeruddin and Surjeet Singh, Modern Algebra, Vikas Publishing, 2006
3. G.C.Sharma, Modern Algebra, Shivlal Agrawal & Co., Agra,1998.
4. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall of India, 1999.
5. Joseph A. Gallian, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999.(IX Edition 2010).
6. S Lang, Introduction to Linear Algebra (2nd edition), Springer, 2005.
7. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
8. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra 2nd Ed., Prentice-Hall Of India Pvt. Limited, 1971.
9. I.N.Herstein, Topics in Algebra, Wiley-Eastern Ltd., New Delhi
   Malcolm Birkoff, Abstract Algebra, Cambridge University Press.

Paper – X: Complex Analysis
Teaching : 3 Hours per Week
Duration of Examination : 3 Hours   **Max. Marks: 85**
Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Complex plane. Connected and Compact sets. Curves and Regions in complex plane. Jordan curve Theorem (statement only). Extended complex plane. Stereographic projection. Complex valued function – Limits, Continuity and Differentiability. Analytic functions, Cauchy-Riemann equations (Cartesian and polar form). Harmonic functions, Construction of an analytic function.

Unit 2: Complex integration, Complex line integrals, Cauchy integral theorem, Indefinite integral, Fundamental theorem of integral calculus for complex functions. Cauchy integral formula, Analyticity of the derivative of an analytic function, Morera's theorem, Poisson integral formula, Liouville' theorem.

Unit 3: Taylor's theorem. Laurent's theorem. Maximum modulus theorem.
Power series – Absolute convergence, Abel's theorem, Cauchy-Hadamard theorem, Circle and Radius of convergence, Analyticity of the sum function of a power series.

Unit 4: Singularities of an analytic function, Branch point, Meromorphic and Entire functions, Riemann's theorem, Casorati-Weierstrass theorem.
Residue at a singularity, Cauchy's residue theorem. Argument principle. Rouche's theorem. Fundamental theorem of Algebra.

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Unit 5: Conformal mapping. Bilinear transformation and its properties. Elementary mappings: $w(z) = \dfrac{1}{2}\left(z + \dfrac{1}{z}\right), z^2, e^z, \sin z, \cos z,$ and $\log z$.

Evaluation of a real definite integral by contour integration. Analytic continuation. Power series method of analytic continuation.

Reference Books:
1. J.C.Chaturvedi and S.S.Seth, Functions of Complex variables, Student's Friends, Agra 1971.
2. H.S.Kasana, Complex Variables: Theory and Applications, Prentice-Hall, Delhi.
3. S. Ponnuswamy, Introduction to Complex Analysis, Narosa Pub., New Delhi
4. R.Murray Spiegel, Theory and Problems of Complex Variables, Schaum Outline Series.
5. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications (Eighth Edition), McGraw – Hill International Edition, 2009.
6. Joseph Bak and Donald J. Newman, Complex analysis (2nd Edition), Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.

Paper – XI: Mechanics
Teaching : 3 Hours per Week
Duration of Examination : 3 Hours　　　　　　　　**Max. Marks:　85**

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Velocity and acceleration – along radial and transverse directions, along tangential and normal directions. S.H.M., Hooke's law, motion along horizontal and vertical elastic strings.

Unit 2: Motion in resisting medium– Resistance varies as velocity and square of velocity. Work and Energy. Motion on a smooth curve in a vertical plane. Motion on the inside and outside of a smooth vertical circle. Projectile.

Unit 3: Central orbits – p-r equations, Apses, Time in an orbit, Kepler's law of planetary motion. Moment of inertia – M.I. of rods, Circular rings, Circular disks, Solid and Hollow spheres, Rectangular lamina, Ellipse and Triangle. Theorem of parallel axis. Product of inertia.

Unit 4: Equilibrium of coplanar force, moments and friction.

Unit-5: Virtual work and Common Catenary.

Reference Books:
1. S.L.Loney - An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Kalyani Publishers, New Delhi.
2. A.S.Ramsey, Dynamics, CBS Publishing & Distributors, New Delhi.
3. A.S.Ramsey, Statics, CBS Publishing & Distributors, New Delhi.
4. M.Ray, A Text Book of Dynamics, S. Chand & Co., 2003.
5. I.H. Shames and G. KrishnaMohan Rao, Engineering Mechanics: Statics and Dynamics (4th Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009.
6. J.L. Synge & B.A. Griffith - Principles of Mechanics, Tata McGraw-Hill, 1959.
7. R.C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics (11th Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.

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Practical: Computer Programming in C
Teaching: 2 Hours per Week per Batch

Examination:			Duration: 2 Hours
Scheme			
Max.Marks			**60**
Min.Pass Marks			**20**

Distribution of Marks:
Two Practicals of

20 Marks each	=	40 Marks	
Practical Record	=	10 Marks	
Viva-voce	=	10 Marks	
Total Marks	=	60 Marks	

The candidates are required to attempt any two practicals using the C or C++ Programming.

Programming languages and problem solving on computers, Algorithm, Flow chart, Programming in C- Constants, Variables, Arithmetic and logical expressions, Input-Output, Conditional statements, Implementing loops in Programs, Defining and manipulation arrays and functions.

Programming in C and execution for the result of

(i). Solution of linear algebraic equations by Gauss elimination method

(ii) Solution of algebraic and transcendental equations by Bisection, False position and Newton – Raphson Methods

(iii) Solution of ordinary differential equations by Euler's and Runga-Kutta 4th order method

(iv) Numerical integration by Trapezoidal and Simpson's one third rule

Note:
1. Each Candidate has to prepare his/her practical record.
2. Each Candidate has to pass in Practical and Theory examinations separately.

Paper – XII: Any One of the Following:

Paper – XII(I): Statistics
Teaching : 3 Hours per Week
Duration of Examination : 3 Hours   **Max. Marks: 100**

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. The candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Frequency distributions and measures of location, Measures of dispersion, Skewness and Kurtosis, Moments of frequency distributions.

Unit 2: Mathematical expectation, Moment generating and Cumulative functions. Discrete probability distributions (Binomial, Poisson, Geometric and Hypergeometric).

Unit 3: Continuous probability distributions (Rectangular and Normal distributions).

Unit 4: Methods of least squares and curve fitting. Correlation and Regression, Multiple and partial correlation.

Unit 5: Theory of probability.

Reference Books:
1. S.C.Gupta and V.K. Kapoor, Fundamental of Mathematical Statistics,S. Chand & Sons., New Delhi.
2. J.N.Kapur and H.C.Saxena, Mathematical Statistics, S.Chand, 2010.
3. A.M. Yagolam and I.M. Yagolam, Probability and Information, Hindustan Publishing Corporation, Delhi, 1983.
4. J. Pitman, Probability, Narosa, 1993.
5. Blake, An Introduction to Applied Probability, John Wiley & Sons, 1979.
6. S.M. Ross, Introduction to Probability Models (Sixth edition) Academic Press, 1997.

Paper- XII(II): Integral Equations and Calculus of Variations
Teaching : 3 Hours per Week
Duration of Examination : 3 Hours   **Max. Marks: 100**

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. The candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Linear Integral Equations- Definition and classification, Conversion of initial and boundary value problems to an integral equation, Eigen values and Eigen functions and their properties for symmetric kernels. Solution of homogeneous and general Fredholm integral equations of second kind with degenerate kernels.

Unit 2: Iterated kernels and their properties. Construction of resolvent kernel with the aid of iterated kernels. Solution of Fredholm and Volterra integral equations of second kind by using resolvent kernel method. Fredholm determinatints. Soluton of Fredholm integral equation of second kind by using Fredholm determinants.

Unit 3: Laplace transform- Definition and its properties. Rules of manipulation. Laplace transform of derivatives and integrals. Properties of inverse Laplace transform. Convolution theorem.

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Unit 4: Abel's integral equation and its generalizations. Application of Laplace transform to solve the Volterra integral equations with convolution type kernels.

Calculus of Variations- Variation and its properties. Euler's equation. Functionals. Functionals dependent on Higher order derivatives and functions of several independent variables.

Unit 5: Variational problems in parametric form. The moving boundary value problem for a function of the form $\int_{x_1}^{x_2} f(x,y,z)\,dx$. Euler's finite difference method. Ritz method for variational problem.

Reference Books:
1. M.D.Raisinghania, Integral Equations and Boundary Value Problems, S.Chand, 2010.
2. A.S.Gupta, Calculus of Variations with Applications, PHI, 1996.
3. Abdul J. Jerry, Introduction to Integral Equations with applications, Marcel Dekkar Inc. NY.
4. L.G.Chambers, Integral Equations: A short Course, Int. Text Book Company Ltd. 1976.
5. Murry R. Spiegal, Laplace Transform (SCHAUM Outline Series), McGraw-Hill.

Paper – XII(III): Calculus of Several Variables
Teaching : 3 Hours per Week
Duration of Examination : 3 Hours Max. Marks: 100

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. The candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Normed vector space, Distance, Inner product. Open and Closed sets. Compactness, Connectedness. Sequence and series. Continuous functions.

Unit 2: Calculus in vector space- Functions on n-space, Space of continuous functions, Differentiability and the chain rule, Properties of derivative. Partial derivatives, Jacobian, Differentiation under integral sign.

Unit 3: Mean value theorem and its applications. Higher derivatives and Taylor's formula. Invertible and implicit functions. Continuously differentiable functions. Maxima and minima.

Unit 4: Multiple integral on R^n. Closed n-rectangle. Lower and upper Riemann sums. Lower and uppr Riemann integrals. Riemann integral. Characteristic function. Admissible function. Admissible set. Criteria for admissibility. Repeated integral. Change of variables.

Unit 5: Ordinary Differential Equations- Integral and Approximate solutions. Lipschitz's property. Comparison of two approximate solutions. Existence and Uniqueness theorem (statement only). Linear differential equation.

Reference Books:
1. Gabriel Klaumber, Mathematical Analysis, Marcel Dekkar, New York 1975.
2. G.B. Thomas, R. L. Finney, M. D. Weir, Calculus and Analytic Geometry, Pearson Education Ltd, 2003.
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 1999.

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6. Geography

B.A./B.Sc. (Hons.) Geography Part-III Examination

Scheme of Examination

Min. Pass Marks 160 (40%)		Max. Marks 400
Paper –IX 3 hour duration	Geography of India	Max. Marks 80
Paper –X 3 hour duration	Evolution of Geographical Thoughts	Max. Marks 80
Paper –XI 3 hour duration	Fundamentals of Agricultural Geography	Max. Marks 80
Paper–XII 3 hour duration	Applied Geography	Max. Marks 80
Practical		Max. Marks 80

Notes

1. Students are permitted to use the stencils, simple calculator and log tables wherever needed in both theory and practical examinations.
2. There will be a common paper for Arts and Science.
3. Q.1 will be compulsory and will cover the entire course of the paper. Q.No. 1 of 20% marks of the total marks be set in two parts.
   - (a) Part (a) will have ten items for locating on a map (to be supplied by examination centre) carrying 10% marks of the maximum marks and candidates shall attempt any five items.
   - (b) Part (b) will have 10 short answer questions carrying 10% marks of the maximum marks and candidates shall attempt any five items.
4. Remaining 9 questions will be set with three questions from each section of the syllabus carrying equal marks.

5. Candidate will attempt 5 questions in all including question No. 1 selecting at least one question from each section.
6. Practical examination will be conducted by the board of examiners.
7. The candidate will have to pass in theory and practical separately.

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SYLLABUS

Paper IX: Geography of India

Section A

India in the context of South and Southeast Asia, geological structure, physiographic divisions, climate: seasons, mechanism of Indian monsoon, major climatic regions; vegetation, major soils and regions; drainage system, water resources and irrigation projects; forests, mineral and power resources: their utilization policy and conservation strategies.

Section B

Agriculture:-typology, major crops, changing pattern of crops, agricultural growth during plan period and green revolution, livestock resources and their development, industrial growth and development; industrial localization with reference to iron and steel, cotton textile, cement and chemical industries, industrial regions; population growth, distribution, problems, policy implication, trends of urbanization and human resource development.

Section C

Regional disparities in economic development, planning and economic regions of India, multilevel planning, problems and prospects of linking of rivers, environmental issues in India, transport development: rail, road, air and waterways, foreign trade: challenges and prospects.

Recommended Readings:

Gautam, Alka, 2010: Geography of India. Rastogi Publications, Meerut.

Gopal Krishnan, R. 2001: Geography of India, Jawaher Publishers & Distributions, New Delhi, 2nd Edition

Khullar, D.R. 2006. India a comprehensive Geography; Kalyani Publishers, New Delhi

मामोरिया, सी, 1999: आधुनिक भारत का वृहत भूगोल। साहित्य भवन पब्लिकेशन्स, आगरा।

Sdasyuk, G. and Sengupta, 1968: Economic Regionalisation of India, Census of India Publication, New Delhi.

Singh, G. 1998: A Geography of India, Atma Ram & Sons, Delhi, Sixth Edition.

Singh, R.L. (ed.) 1971: India: A Regional Geography. NGSI, Varanasi.

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Spate, O.H.K. and Learmonth, A.T.A. 1967: India and Pakistan, Land, People and Economy, Methuen and Co., London.

Tirtha, R 2000: Geography of India, Rawat Publications, Jaipur 2nd Edition (India)

तिवारी, आर.सी 2012 भारत का भूगोल। प्रयाग पुस्तक भवन, इलाहाबाद।

Paper X: Evolution of Geographical Thought

Section A

The scope and nature of geography in the ancient classical period, contributions of Herodotus, Eratosthenes, Strabo and Ptolemy, dark age, development of Geography during medieval period with special reference Al-Biruni, Al-Masudi, Ibn Batutta and Ibn Khaldun.

Section B

The revival of geography from the 14th to the 18th century, works of Varenius and Kant; foundation of modern of geography, contributions of Humboldt and Ritter, Ratzel, Mackinder, dualism and its implication in the development of geography: physical versus human geography, regional versus systematic, determinism versus possibilism, qualitative versus quantitative geography.

Section C

Basic concepts in geography: geography is the study of areal differention and landscape morphology, regions: concept and types, geography as human ecology and environmental science, quantitative revolution, development of Geography in India.

Recommended Readings:

Adhikari, S. 2009. Fundamentals of Geographical Thought. Chaitanya Publishing House, Allahabad.

Dickinson, R. E. 1967. The Makers of Modern geography. Routledge & Kegan Paul Limited. London.

Dikshit, R. D. 2004. Geographical Thought: A Critical History of Ideas. Prentice-Hall of India, New Delhi. (in English and Hindi).

Holt-Jensen, A. 1988. Geography: History and Concepts — A Student's Guide. Sage, Los Angeles (Fourth Edition).

James, P.E., All Possible Worlds 1972: A History of Geographical Ideas; Odessey Press, 622 pages.

जैन, एस.एम. 2005 भौगोलिक चिन्तन एवं विधि तंत्र। साहित्य भवन पब्लिकेशन्स, आगरा।

Johnston, R. et al 2003: The Dictionary of Human Geography. Blackwell Publishers, Oxford 5th edition.

Majid. H. 2007. Evolution of Geographical Thought. Rawat Publications, Jaipur

मौर्य, एस.डी. 2007. भौगोलिक चिन्तन का इतिहास, प्रयाग पुस्तक भवन, इलाहाबाद।

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Paper XI: Fundamentals of Agricultural Geography

Section A

Meaning, nature, scope and approaches (systemic and regional) of agricultural geography, determinants of agricultural land use: physical, social, economic and cultural.

Section B

Concept of agricultural region: Whittlesey's classification of agricultural regions, agricultural typology, land use and land capability classification: methods and applications.

Section C

Agro-climatic regions of India and their characteristics, green revolution: its impact and consequences, agricultural policy in India and contemporary issues: nutrition, hunger and food security.

Recommended Readings:

Husain, M., 1996: Systematic Agricultural Geography, Rawat Publication, Jaipur.

कुमार, पी. एवं शर्मा, एस. 1996: कृषि भूगोल। मध्य प्रदेश हिन्दी ग्रन्थ अकादमी, भोपाल।

Morgan, W.B. and Muton. R.J.C.1971: Agriculture Geography. Methuen, London.

Singh, J. and Dhillon, S.S. 1984: Agricultural Gegoraphy, Tata McGraw Hill Publishing Co. Ltd. New Delhi.

Shafi, M. 2000: Agricultural Geography of Asia. Macmillan, New Delhi.

तिवाड़ी, आर.सी. एवं सिंह, बी.एन. 1994: कृषि भूगोल। प्रयाग पुस्तक भवन इलाहाबाद।

Paper XII: Applied Geography

Section A

Nature, scope and content of applied geography, identification of problems of interdisciplinary nature like environments resource base, resource utilization sustainable development, issues related to spatial variations in physical environments, land capability, agricultural productivity, environmental degradation, environmental challenges and environmental management.

Section B

Issues related to human resource development: quality versus numbers, social and demographic issues: diversity and disparity; carrying capacity of the earth, man power planning and employment, issues related to economy· spatial organization of economic activities (like agriculture, industry, transport, trade etc.).

Section C

Environment and sustainable development with a focus on man-environment relationship: regional and interregional stresses, review of policies and multiple planning: local, regional and national level with special reference to India.

Recommended Readings:

Bhat, L.S. et al 1976: Micro-Level planning: A Case Study of Karnal Area. Haryana, K.B. Publications, New Delhi.

Blair, J. P. and Carroll. M. C. 2009. Local Economic Development - Analysis, Practices, and Globalization. SAGE PUBLICATIONS, INC., NEW DELHI.

Dutta, A.K., et al 2008 (eds.): Explorations in Applied Geography. Printice-Hall of India Private Limited, New Delhi.

Friedmann, J. 1992: Empowerment: The Politics of Alternative Development. Blackwell, Oxford.

Gupta, P., and Sdasyuk, G. 1968: Economic Regionalization of India: Problems and Prospects. Census of India, New Delhi

Johnson, E.A.J. 1970: The Origanisation of Space in Developing Countries. Harvard University Press, Cambridge.

Kundu, A. and Raza, M. 1982: Indian Economy, The Regional Dimension. Spectrum Publishers, New Delhi.

Misra, R. P. (ed.) 1992: Regional Planning: Concepts, Techniques, Policies and Case Studies. 2nd edition. Concept Publishing Company., New Delhi.

Pathak, C. R. 2003: Spatial Structure and Processes of Development in India. Regional Science Association., Kolkata.

Raza, M. 1988: Contributions to Indian Geography. Volume X, Regional Development, Heritage Publishers, New Delhi.

श्रीवास्तव, वी.के. 1997: प्रादेशिक नियोजन और सन्तुलित विकास। वसुन्धरा प्रकाशन, गोरखपुर।

Practicals

Scheme of examination

Min. Pass Marks: 32

Max. Marks: 80

	Marks	Time
Written test	30	3 hrs.
Field survey and viva voce	10+05	2½ hrs.
Report of socio- economic survey and viva voce	10+05	
Record and viva voce	12 + 08	
Total Marks	80	

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

from each section. All question carry equal marks.

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SYLLABUS

Section A

Map projections: bases of classification, uses and choice of projections.
Mathematical construction of map projections: cylindrical –simple, equal area and Mercator's

Section B

Conical: one standard partial two standard parallels, Bonne's, polyconic and modified polyconic (international).
Zenithal: equidistant and equal area (Polar cases only), gnomonic, stereographic, orthographic.

Section C

Conventional: sinusoidal and Mollwede's (normal cases only).
Dumpy level: survey and contouring.
Socio-economic survey of a town/village: survey planning, data collection, compilation, analysis and interpretation, report writing

Recommended Reading:

चौहान, पी.आर. 2005: प्रयोगात्मक भूगोल। क्सुन्धरा प्रकाशन, गोरखपुर।

Khullar, D.R. 2000: Essentials of Practical Geography. New Academic Publishing Co., Jalandhar.

Punmia, B.C. 1988: Surveying and Field Work. Laxmi Publications, New Delhi Vol. I.

Robinson, A.H. et al. 2004: Elements of Cartography. John Wiley & Sons, Inc., New York.

Rampal, K.K. 1993: Mapping and Compilation: Methods and Techniques Concept. Publishing Company, New Delhi.

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

Singh, R.L. and Singh RPB 1991: Elements of Practical Geography. Kalyani Publishers, New Delhi.

तिवारी, आर.सी. एवं सुधाकर, त्रिपाठी 2009: प्रयोगात्मक भूगोल। प्रयाग पुस्तक भवन, इलाहाबाद।

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7. PSYCHOLOGY

B.A./B.Sc. Honours Part-III

SCHEME OF EXAMINATION :

Papers	Nomenclature	Duration	Max. Marks	Min. Pass Marks
Paper-IX	Applied Psychology	3 Hrs.	75	
Paper-X	Positive Psychology	3 Hrs.	75	
Paper-XI	Theories of Personality	3 Hrs.	75	120
Paper-XII	Psychological Testing	3 Hrs.	75	
Practicals		3 Hrs.	100	40

NOTE :-

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

Section-A   will contain 10 questions of 20 words consisting of 1.5 marks each. Thus, Part-A will be of 15 marks.

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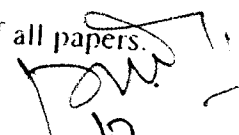
Section-C   will contain 3 long questions each with internal choice. Each question will be of 15 marks. Thus, Part-C will be of 45 marks.

For clarification the distribution of marks is tabulated as below:-

Section	B.A. Honours (Psychology) Part-I		
	No. of Questions	Marks	Total
A	10	1.5	15
B	5 (Out of 7)	03	15
C	3 (with internal choice)	15	45
		Total Marks	75

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

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Paper-IX:

Applied Psychology

Section-A

1. Psychology in Industry : Personnel selection and classification.

2. Personal/Personnel Assessment Techniques : Development and Training; Attitude and Motivation.

3. Organizational Psychology : Leadership and Supervision, Participated Management, Job Design, Organizational Structure and Climate, Communication.

Section-B

4. Engineering Psychology : Human performance; Human factors in Equipment Design.

5. Stress Management: Psychological Determinants and Stress Management.

6. Information Technology and Mass Media, Understanding Wellbeing and Human Rights through Information Technology; Media and Communication, Media Violence and Cyber Crime.

Section-C

7. Psychology in Education: School System, Measurement and Evaluation, Instructional Psychology, Behaviour Modification in School Set-up.

8. Community Psychology : Concept and Goals; Social Change and Social Action, Arousing Community Consciousness.

9. Sports Psychology: Meaning, Nature and Scope; Psychological Skills in Sports.

Books Recommended:

- Anastasi A. (1979) - Fields of Applied Psychology. New York, McGraw Hill (International Ed.) Tokyo.

- Schien (1967) - Organizational Psychology. New Delhi. Prentice-Hall.

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- Korchin, S. (1976) - Modern clinical Psychology, Basic Books, Inc. Publications, New York.

- Bunt-Applied Psychology.

- Poffenberger-Principles of Applied Psychology

- Mohan, J. Chaddha, N.K. and Akhtar, S.S. (1992).Psychology of Sports Friends Publications, Delhi.

Paper-X:

Positive Psychology

Section A

1. Introduction : Definition, Goals; Assumptions and Historical Perspective; Relationships with other Branches of Psychology.

2. Eastern and Western Perspectives on Positive Psychology.

3. Virtues and Strengths of Characters : Classification and Measures of Human Strength-Gallup's Clifton Strength Finder. The VIA Classification. Identifying Personal Strengths.

Section B

4. Happiness and Wellbeing: Definition; Hedonic and Eudaimonic basis of Happiness; Subjective Wellbeing, Psychological Wellbeing and Social Wellbeing.

5. Resilience: Meaning, Developmental and Clinical Perspective, Sources of Resilience, Successful Aging and Growth through Trauma.

6. Pro-Social Behavior: Empathy, Altruism, Gratitude and Forgiveness

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Section C

7. Self-Regulation and Self Control : Theories and Planning for Self-Regulation Success, Self Regulations Problems – Goal Conflict, Goal Difficulty and Goal Disengagement

8. Positive Cognitive States and Processes : Self Efficacy, Optimism, Hope, Mindfulness, Flow and Spirituality.

9. Positive Emotional States and Processes : Meaning, Theories and Resources of Positive Emotions; Emotional Intelligence; Emotional Focused Coping.

Books Recommended:

- Snyder, C.R. Lopez, S.J.(2007).*Positive psychology.* New Delhi: Sage.

- Snyder, C.R. Lopez. J.(2005). *Handbook of positive psychology.* New York: Oxford

- Wong, P.T. and Fry, (1998). *The human quest for meaning. Mahwah,* New Jersey: Lawrence, Erlbum.

- Baumgardner, S. Crothers, M. (2009). *Positive psychology.* New Delhi: Pearson education.

- Mohan & Sehgal – Positive Psychology.

Paper-XI:

Theories of Personality

Section-A

1. Introduction : Definition. History and Basic Issues. Biological and Cultural Determinants of Personality

2. Psychoanalytic Theories : Freud and Modern Developments.

3. Neo-Analytic and Ego Theories : Jung, Adler, Horney and Erikson.

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Section-B

4. Biological Theories: Genetic Effects and Temperament; Sociobiological and Evolutionary Factors.

5. Behavourist and Learning Theories : Watson, Skinner, Dollard and Miller.

6. Cognitive and Social Cognitive Theories : Kelly, Seligman, Rotter and Bandura.

Section-C

7. Trait Theories: Cattell, Allport and Big Five Model.

8. Humanistic and Existential Theories: Fromm, Rogers and Maslow.

9. Person-Situation Interactionist Theories : Sullivan, Murray and Michelle.

Books Recommended:

- Hall & Lindzey (1978) - Theories of Personality, New York, Wiley.

- Michelle, W. - Theories and Assessment of Personality

- Friedman, H.S. & Schustack, M.W. (2003) Personality : Classical Theories and Modern Research. New Delhi, Pearson Education.
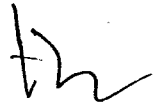
Paper-XII:

Psychological Testing

Section-A

1. Psychological Measurement and Testing : Need and Origin.

2. Scaling: Kinds, Characteristics and Uses of Scaling.

3. Psychological Tests: Nature, Functions and Current Uses; Kinds of Tests: Individual and Group Test. Characteristics of a Good Test.

4. Problems in the Test Administration: Testing Programme, Professional Ethics, Controlling the Use of Psychological Tests, Problems of Report and Administration; Guidelines for Testing Programmes.

5. Problems of Test Construction : Drafting and Compilation of Test Items. Item Analysis; Issues of Reliability, Validity and Need for Cross Validation.

6. Test Standardization : Procedure, Establishment of Norms, Interpretation and Application of Test Scores, Prediction Value of Test.
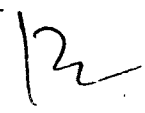
Section-C

7. Tests of Intelligence: Nature and Types- Verbal Tests, Non-language Tests, Performance Test, Test for Measuring Adult Intelligence, Special Tests; Culture Fair Tests.

8. Tests of Interest and Aptitude: Interest Tests:- Educational and Vocational; Attitude Tests; Aptitude Tests; Academic Tests - Achievement Tests.

9. Tests of Personality: Self-Report Test, Inventories, Projective Techniques - Verbal, Non-verbal, T.A.T. and Rorschach, Situational Tests and Expressive Techniques.

Books Recommended:

*   Anastasi, A. (1988) - Psychological Testing. Macmillan company, London.

*   Chronbach, L. (1970) - Essentials of Psychological Testing. Tokyo. Harper International Edition, 3rd Ed.

*   Freeman (1963) - Theory and practice of Psychological Testing, New Delhi, Oxford & IBH, 3rd Ed.

*   Guilford, J.P. (1974) - Psychometric Methods, N.D. Tata McGraw Hill.

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Practicals

1. Reaction Time

2. Saving Method

3. Two Point Threshold

4. Work and Fatigue

5. Picture Frustration Study

6. Career Interest Checklist by Holland

7. NEO – PRI

8. Differential Aptitude Test

9. Rorschach Test

10. Assessment of Altruism

11. Assessment of Emotional Intelligence

12. Assessment of Need Achievement (Projective Method)