



# हेमचंद यादव विश्वविद्यालय, दुर्ग (छ. ग.)

रायपुर नाका, दुर्ग (छ.ग.) 491001

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क्र. 4824 / प्रवेश / अकादमिक / 2026

दुर्ग, दिनांक 12.06.2026

## // अधिसूचना //

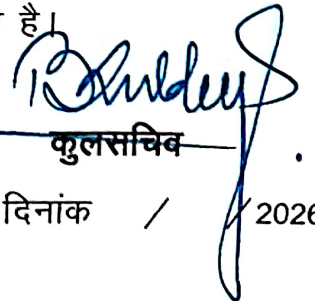
### प्रवेश परीक्षा – 2026 (Entrance Exam- 2026)

हेमचंद यादव विश्वविद्यालय, दुर्ग के अध्ययनशाला (UTD), हेतु शैक्षणिक सत्र 2026-27 के लिए विभिन्न पाठ्यक्रमों एम.एस-सी.- गणित, एम.एस-सी.- भौतिकी, एम.एस-सी.- रसायनशास्त्र, एम.एस-सी.- वनस्पतिविज्ञान, एम.एस-सी.- प्राणीविज्ञान में प्रवेश हेतु ऑनलाईन प्रवेश परीक्षा (Entrance Exam) आयोजित किया जा रहा है। इच्छुक विद्यार्थी ऑनलाईन [Link- www.durguniversity.ac.in](http://www.durguniversity.ac.in) के Quick Links पर जाकर Application For Entrance Exam- 2026 पर [Click](#) कर प्रवेश परीक्षा हेतु आवेदन कर सकते हैं। प्रवेश परीक्षा विश्वविद्यालय द्वारा निर्धारित पाठ्यक्रम एवं नियमों के अनुसार होगा:-

#### महत्वपूर्ण तिथियाँ

1. ऑनलाईन आवेदन प्रारंभ होने की तिथि: 16.06.2026
2. ऑनलाईन आवेदन की अंतिम तिथि: 30.06.2026
3. परीक्षा तिथि: 12.07.2026
4. मेरिट सूची/काउंसलिंग संबंधी सूचना: विश्वविद्यालय वेबसाईट पर पृथक रूप से प्रकाशित की जाएगी।

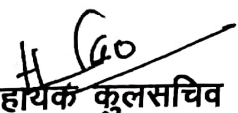
प्रवेश परीक्षा पाठ्यक्रम एवं नियम-निर्देश विश्वविद्यालय के वेबसाईट पर उपलब्ध है।

  
कुलसचिव  
दुर्ग, दिनांक / 2026

पृ. क्र. 4825/अका./2026

#### प्रतिलिपि :-

1. कुलपति महोदय के निज सहायक, हेमचंद यादव विश्वविद्यालय, दुर्ग (छ.ग.)

  
सहायक कुलसचिव (अका.)

**HEMCHAND YADAV VISHWAVIDYALAYA,  
DURG, CHHATTISGARH, INDIA**



**Syllabus for PG Entrance Exam 2026-27**

**For University Teaching Department Admission 2026-27**

<https://www.durguniversity.ac.in>

## M.Sc. Mathematics

### एम.एससी. (गणित)

#### Calculus:

$\epsilon$  -  $\delta$  definition of the limit of a function. Basic properties of limits. Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions. Integration of transcendental functions. Reduction formulae. Definite integrals. Quadrature. Rectification. Volumes and surfaces of solids of revolution.

Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion. Series of non-negative terms. Comparison tests, Cauchy's integral test, Ratio tests, Raabe's, logarithmic, de Morgan and Bertrand's tests. Alternating series, Leibnitz's theorem. Absolute and conditional convergence. Continuity, Sequential continuity, Properties of continuous functions, Uniform continuity, Chain rule of differentiability, Mean value theorems and their geometrical interpretations. Darboux's intermediate value theorem for derivatives, Taylor's theorem with various forms of remainders. Limit and continuity of functions of two variables. Partial differentiation. Change of variables. Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables. Jacobians. Envelopes, evolutes. Maxima, minima and saddle points of functions of two variables. Lagrange's multiplier method.

#### Algebra:

Elementary operations on matrices, Inverse of a matrix. Linear independence of row and column matrices, Row rank, column rank and rank of a matrix. Equivalence of column and row ranks. Eigenvalues, eigenvectors and the characteristic equations of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix. Application of matrices to a system of linear (both homogeneous and nonhomogeneous) equations. Theorems on consistency of a system of linear equations.

Mappings, Equivalence relations and partitions. Congruence modulo  $n$ . Definition of a group with examples and simple properties. Subgroups, generation of groups, cyclic groups, coset decomposition, Lagrange's theorem and its consequences. Fermat's and Euler's theorems. Normal subgroups. Quotient group, Permutation groups. Even and odd permutations. The alternating groups  $A_n$ . Cayley's theorem. Homomorphism and Isomorphism the fundamental theorems of homomorphism. Automorphisms, inner automorphism. Automorphism groups and their computations, Conjugacy relation, Normaliser, Counting principle and the class equation of a finite group. Center for Group of prime- order, Abelianizing of a group and its universal property. Sylow's theorems, Sylow subgroup, Structure theorem for finite Abelian groups. Ring theory- Ring homomorphism. Ideals and quotient rings. Field of quotients of an integral domain, Euclidean rings, polynomial rings, Polynomials over the rational field. The Eisenstein criterion, polynomial rings over commutative rings, Unique factorization domain.  $R$  unique factorisation domain implies so is  $R[X_1, X_2, \dots, X_n]$ . Modules, Submodules, Quotient modules, Homomorphism and Isomorphism theorems. Definition examples of vector spaces. Subspaces. Sum and direct sum of subspaces. Linear span, linear dependence, independence and their basic properties. Basis. Finite dimensional vector spaces. Existence theorem for bases. Invariance of the number of elements of a basis set. Dimension. Existence of complementary subspace of a subspace of a finite dimensional vector space. Dimension of sums of subspaces. Quotient space and its dimension.

Linear transformations and their representation as matrices. The Algebra of linear transformations. The rank nullity theorem. Change of basis. Dual space. Bidual space and natural isomorphism. Adjoint of a linear transformation. Eigenvalues and eigenvectors of a linear transformation. Diagonalisation. Annihilator of a subspace. Bilinear, Quadratic and Hermitian forms. Inner Product Spaces-Cauchy- Schwarz inequality. Orthogonal vectors. Orthogonal Complements. Orthonormal sets and bases. Bessel's inequality for finite dimensional spaces. Gram-Schmidt Orthogonalization process.

## **Differential Equations:**

Degree and order of a differential equation. Equations reducible to the linear form. Exact differential equations. First order higher degree equations solvable for  $x$ ,  $y$ ,  $p$ . Clairaut's form and singular solutions. Geometrical meaning of a differential equation. Orthogonal trajectories. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Linear differential equations of second order. Transformation of the equation by changing the dependent variable/the independent variable. Method of variation of parameters. Ordinary simultaneous differential equations.

Laplace Transformation- Linearity of the Laplace transformation, Existence theorem for Laplace transforms, Laplace transforms of derivatives and integrals, Shifting theorems. Differentiation and integration of transforms. Convolution theorem. Solution of integral equations and systems of differential equations using the Laplace transformation. Partial differential equations of the first order. Lagrange's solution, some special types of equations which can be solved easily by methods other than the general method, Charpit's general method of solution. Partial differential equations of second and higher orders, Classification of linear partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Monge's methods.

## **Analysis:**

Series of arbitrary terms. Convergence, divergence and oscillation. Abel's and Dirichlet's test. Multiplication of series. Double series. Partial derivation and differentiability of real-valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Fourier series. Fourier expansion of piecewise monotonic functions. Riemann integral. Integrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus. Improper integrals and their convergence. Comparison tests. Abel's

and Dirichlet' tests. Frullani's integral. Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter.

Complex numbers as ordered pairs. Geometric representation of complex numbers. Stereographic projection. Continuity and differentiability of complex functions. Analytic functions. Cauchy- Riemann equations. Harmonic functions. Elementary functions. Mapping by elementary functions. Mobius transformations. Fixed points, Cross ratio. Inverse points and critical mappings. Conformal mappings.

### **Metric Spaces:**

Definition and examples of metric spaces. Neighbourhoods, limit points, interior points, open and closed sets, closure and interior. Boundary points, Sub-space of a metric space. Cauchy sequences, completeness, Cantor's intersection theorem. Contraction principle, construction of real numbers as the completion of the incomplete metric space of rationals. Real numbers as a complete ordered field. Dense subsets. Baire Category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem. Uniform continuity, isometry and homeomorphism. Equivalent metrics. Compactness, sequential compactness. Totally bounded spaces. Finite intersection property. Continuous functions and compact sets, connectedness, components, continuous functions and connected sets.

**M.Sc. Physics**  
**एम.एससी. (भौतिकी)**

**Mechanics, Oscillations and Properties of Matter**

Cartesian, Cylindrical and Spherical coordinate system, Inertial and non-inertial frames of reference, uniformly rotating frame, Coriolis force and its applications. Motion under a central force, Kepler's laws. Effect of Centrifugal and Coriolis forces due to earth's rotation, Center of mass (C.M.), Lab and C.M. frame of reference, motion of C.M. of system of particles subject to external forces, elastic, and inelastic collisions in one and two dimensions, Scattering angle in the laboratory frame of reference, Conservation of linear and angular momentum, Conservation of energy.

Rigid body motion, rotational motion, moments of inertia and their products, principal moments & axes, introductory idea of Euler's equations. Potential well and Periodic Oscillations, case of harmonic small oscillations, differential equation and its solution, kinetic and potential energy, examples of simple harmonic oscillations: spring and mass system, simple and compound pendulum, torsional pendulum.

Bifilar oscillations, Helmholtz resonator, LC circuit, vibrations of a magnet, oscillations of two masses connected by a spring. Superposition of two simple harmonic motions of the same frequency, Lissajous figures, damped harmonic oscillator, case of different frequencies. Power dissipation, quality factor, examples, driven (forced) harmonic oscillator, transient and steady states, power absorption, resonance.

Effect of E and B on charge particles, E as an accelerating field, electron gun, case of discharge tube, linear accelerator, Transverse B field, mass spectrograph, principle of a cyclotron. Mutually perpendicular E and B fields, Parallel E and B fields, principle of magnetic focusing lens.

Elasticity: Strain and stress, elastic limit, Hooke's law, Modulus of rigidity, Poisson's ratio, Bulk modulus, relation connecting different elastic- constants, twisting couple of a cylinder (solid and hollow), Bending moment, Cantilever, Young modulus by bending of beam.

Viscosity: Poiseuille's equation of liquid flow through a narrow tube, equations of continuity. Euler's equation, Bernoulli's theorem, viscous fluids, streamline and turbulent flow. Poiseuille's law, Coefficient of viscosity, Stoke's law, Surface tension.

### **Electricity, Magnetism and Electromagnetic Theory**

Gradient of a scalar field and its geometrical interpretation, divergence and curl of a vector field, and their geometrical interpretation, line, surface and volume integrals, flux of a vector field. Gauss's divergence theorem, Green's theorem and Stoke's theorem and their physical significance. Kirchhoff's law.

Coulomb's law, Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Relation between Electric potential and Electric field, torque on a dipole in a uniform electric field and its energy, flux of the electric field. Gauss's law and its applications.

Dielectric constant, Polar and Non Polar dielectrics, Dielectrics and Gauss's Law, Dielectric Polarization, Electric Polarization vector  $\mathbf{P}$ , Electric displacement vector  $\mathbf{D}$ . Dielectric susceptibility and permittivity, Polarizability and mechanism of Polarization, Lorentz local field, Clausius-Mossotti equation, Debye equation.

Ferroelectric and Paraelectric dielectrics, Steady current, current density  $\mathbf{J}$ , non-steady currents and continuity equation, rise and decay of current in LR, CR and LCR circuits, decay constants, AC circuits, complex numbers and their applications in solving AC circuit problems, complex impedance and reactance, series and parallel resonance, Q factor, power consumed by an a AC circuit, power factor.

Magnetization Current and magnetization vector  $\mathbf{M}$ , three magnetic vectors and their relationship, Magnetic permeability and susceptibility, Diamagnetic, paramagnetic and ferromagnetic substances. B-H Curve, cycle of magnetization and hysteresis, Hysteresis loss, Biot-Savart's Law and its applications, Ampere's law.

Electromagnetic induction, Faraday's law, electromotive force, Mutual and self inductance, Transformers, energy in a static magnetic field. Maxwell's displacement current, Maxwell's equations, electromagnetic field energy density. The wave equation satisfied by  $\mathbf{E}$  and  $\mathbf{B}$ , plane electromagnetic waves in vacuum, Poynting vector.

### **Thermodynamics, Kinetic Theory and Statistical Physics**

The laws of thermodynamics : The Zeroth law, first law of thermodynamics, internal energy as a state function, reversible and irreversible change, Carnot's cycle, carnot theorem, second law of thermodynamics. Claussius theorem inequality, Entropy, The thermodynamic scale of temperature, Third law of thermodynamics, Concept of negative temperature.

The laws of thermodynamics : The Zeroth law, first law of thermodynamics, internal energy as a state function, reversible and irreversible change, Carnot's cycle, carnot theorem, second law of thermodynamics. Claussius theorem inequality, Entropy, The thermodynamic scale of temperature, Third law of thermodynamics, Concept of negative temperature.

Maxwellian distribution of speeds in an ideal gas: Distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values. Doppler broadening of spectral lines. Transport phenomena in gases: Molecular collisions mean free path and collision cross sections. Estimates of molecular diameter and mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure, Behaviour of Real Gases.

Probability and thermodynamic probability, principle of equal a priori probabilities, statistical postulates. Concept of Gibb's ensemble, accessible and inaccessible states. Concept of phase space, Equilibrium before two systems in thermal contact, probability and

entropy, Boltzmann entropy relation. Boltzmann canonical distribution law and its applications, law of equipartition of energy.

Bose-Einstein & Fermi-Dirac conditions, Concept of partition function, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics and their applications.

### **Waves, Acoustics and Optics**

Waves, Speed of transverse waves on uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves. Waves over liquid surface: gravity waves and ripples. Group velocity and phase velocity, Ultrasonic and infrasonic waves, Reflection, refraction and diffraction of sound, transducers, principle of a Sonar system, sound ranging.

Fermat's Principle of extremum path, the aplanatic points of a sphere and other applications. Cardinal points of an optical system, thick lens and lens combinations. Lagrange's equation of magnification, telescopic combinations, telephoto lenses. Monochromatic aberrations and their reductions; aspherical mirrors and Schmidt corrector plates. Interference of light, Thin films. Newton's rings and Michelson interferometer and their applications, Fabry-Perot interferometer.

Diffraction, Types of Diffraction, Fresnel's diffraction, half-period zones, phasor diagram and integral calculus methods, the intensity distribution, Zone plates, diffraction due to straight edge, Fraunhofer diffraction due to a single slit and double slit, Diffraction at N-Parallel slit, Plane Diffraction grating, Rayleigh criterion, resolving power of grating, Prism, telescope.

Polarization of light, Production of polarized light by reflection, refraction and scattering. Polarization by double refraction and Huygen's theory, Nicol prism, Retardation plates, Production and analysis of circularly and elliptically polarized light.

Basic properties of Lasers, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, conditions for laser action, population inversion, Types of Laser : Ruby and, He-Ne laser and Applications

of laser : Application in communication, Holography and Basics of non linear optics and Generation of Harmonic.

### **Relativity, Quantum Mechanics, Atomic Molecular and Nuclear Physics**

Reference systems, inertial frames, Galilean invariance propagation of light, Michelson-Morley experiment, Ether, Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition, variation of mass with velocity, mass-energy equivalence, particle with zero rest mass.

Origin of the quantum theory : Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect, Compton effect, Wave-particle duality, uncertainty principle, de Broglie's hypothesis for matter waves, the concept of Phase and group velocities, Davisson and Germer's experiment. Consequence of de Broglie's concepts, Bohr's atomic model, energies of a particle in a box, wave packets, Uncertainty relation.

Schrodinger's equation, Statistical interpretation of wave function, Orthogonality and normalization of wave function, Probability current density, Operators, expectation values, Ehrenfest's theorem, transition probabilities, applications to particle in a one and three dimensional boxes, harmonic oscillator in one dimension, reflection at a step potential, transmission across a potential barrier.

Spectra of hydrogen, deuterium and alkali atoms spectral terms, doublet fine structure, selection rules. Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of inter-nuclear distance, rotational, vibrational and rotational-vibrational spectra, Transition rules, Dissociation limit for the ground and other electronic state, Raman effect, Stokes and anti-Stokes lines.

Interaction of charged particles and neutrons with matter, working of nuclear detectors, G-M counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions, Structure of nuclei, deuteron binding energy, p-p and n-p scattering and general

concepts of nuclear forces, Beta decay, alpha decay and continuous and discrete spectra. Nuclear reactions.

### **Solid State Physics, Solid State Devices and Electronics**

Amorphous and crystalline solids, Elements of symmetry, seven crystal systems, Cubic lattices, Crystal planes, Miller indices, Laue's equation for X-ray diffraction, Bragg's Law, Bonding in solids, classification. Cohesive energy of solid, Madelung constant, evaluation of Parameters, Specific heat of solids, classical theory (Dulong-Petit's law), Einstein and Debye theories, Vibrational modes of one dimensional monoatomic lattice, Dispersion relation, Brillouin Zone.

Free electron model of a metal, Solution of one dimensional Schrödinger equation in a constant potential, Density of states, Fermi Energy, Energy bands in a solid (Kronig- Penny model without mathematical details), Difference between Metals, Insulator and Semiconductors, Hall effect, Dia, Para and Ferromagnetism, Langevin's theory of dia and para-magnetism, Curie-Weiss's Law, Qualitative description of Ferromagnetism (Magnetic domains), B-H curve and Hysteresis loss.

Intrinsic and extrinsic semiconductors, Concept of Fermi level, Generation and recombination of electron hole pairs in semiconductors, Mobility of electrons and holes, drift and diffusion currents, p-n junction diode, depletion width and potential barrier, junction capacitance, I-V characteristics, Tunnel diode, Zener diode, Light emitting diode, solar cell, Bipolar transistors, pnp and npn transistors, characteristics of transistors, different configurations, current amplification factor, FET and MOSFET Characteristics.

Half and full wave rectifier, rectifier efficiency ripple factor, Bridge rectifier, Filters, Inductor filter, L and  $\pi$  section filters, Zener diode, regulated power supply using zener diode, Applications of transistors, Bipolar Transistor as amplifier, h-parameter, h-parameter equivalent circuit, Transistor as power amplifier, Transistor as an oscillator, principle of an oscillator and Barkhausen's condition, requirements of an oscillator, Wein-Bridge oscillator and Hartley oscillator.

Digital Circuits: Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gate, De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Digital to Analog Converter, Analog to Digital Converter.

**M.Sc. Chemistry**  
**एम.एससी. (रसायन शास्त्र)**

**Inorganic Chemistry**

- Chemical periodicity
- Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory).
- Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.
- Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds.
- Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms.
- Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
- Organometallic compounds: synthesis, bonding, structure, and reactivity. Organometallics in homogeneous catalysis.
- Cages and metal clusters.
- Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods.
- Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine.
- Characterization of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.
- Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

**Physical Chemistry**

- Basic principles of quantum mechanics: Postulates; operator algebra; exactly- solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling.

- Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.
- Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.
- Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated  $\pi$ -electron systems.
- Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.
- Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.
- Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.
- Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems.
- Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.
- Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.
- Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.
- Solid state: Crystal structures; Bragg's law and applications; band structure of solids.
- Polymer chemistry: Molar masses; kinetics of polymerization.

- Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

## Organic Chemistry

- IUPAC nomenclature of organic molecules including regio- and stereoisomers.
- Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.
- Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions.
- Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzyne and nitrenes.
- Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.
- Common named reactions and rearrangements – applications in organic synthesis.
- Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations.
- Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.
- Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution – optical and kinetic.
- Pericyclic reactions – electrocycloisatation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.
- Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).
- Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids.

- Structure determination of organic compounds by IR, UV-Vis,  $^1\text{H}$  &  $^{13}\text{C}$  NMR and Mass spectroscopic techniques.

### **Analytical and Advanced Instrumentation**

- Principle, classification of chromatographic techniques, Technique and applications of paper chromatography, Thin-layer chromatography, HPTLC, Column chromatography. Liquid and Gas chromatography.
- Principle, Instrumentation, Applications of TGA, DTA and DSC methods, C/H/S/N/O Analyzer.
- Mathematical and statistical methods involved in the calculations in analytical chemistry
- Theory, instrumentation and application of flame photometer, X-ray photo electron spectroscopy (XPS), Photo acoustic Spectroscopy (PAS), AES, ICP-AES and AFS.
- Air and Water pollution monitoring and analysis
- Chemical analysis involved in cement, iron processing, coal and thermal power plant.
- Fundamentals of nanoscience, supramolecular chemistry and analytical methods of synthesis involved.

**M.Sc. (Botany/Zoology)**  
**एम.एससी. (वनस्पति विज्ञान / प्राणी विज्ञान)**

**Plant Biology (Only for M.Sc. Botany)**

- Plant Biology: General characteristics of Angiosperm (Dicot and Monocot), Gymnosperm (Cycas, Pinus and Ephedra) and Pteridophyta (Marsilea, Azolla and Equisetum).
- Photosynthesis, respiration, plant hormones, water and mineral nutrition.

**Animal Biology (Only for M.Sc. Zoology)**

- Animal Biology: Classification of Invertebrates (Protozoa, Porifera, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca, Echinodermata) and Chordates (Pisces, Amphibia, Reptilia, Aves, Mammalia).
- Animal physiology: Nervous, endocrine, cardiovascular, respiratory, excretory, and reproductive systems.

**General Biology**

- Cell Biology: Structure and function of cell and organelles, cell cycle, and cell division
- Genetics: Mendelian genetics, linkage and recombination, molecular basis of inheritance

**Ecology and Environment**

- Evolution and Ecology: Theories of evolution, ecosystem, Food chain, food web, pyramids, productivity.
- Pollution, Biodiversity and conservation, Natural disaster, Climate change, sustainable Development.

## **Microbiology and Immunology**

- Microbial classification, occurrence, distribution, structure, and economic importance of Algae, Bacteria, Fungi, Virus.
- Pathogenic microorganisms and infectious diseases.
- Immune system: Innate and adaptive immunity, antigen-antibody interactions, vaccines.

## **Biochemistry**

- Biomolecules: Carbohydrates, proteins, lipids, nucleic acids
- Enzymes: Classification, Structure, Function, and Kinetics
- Vitamins and hormones

## **Instrumentation and Techniques**

- Microscopy (principle and staining methods), Chromatography (Paper, Thin layer, Gas, and HPLC)
- Principle, techniques, and applications of Centrifugation and Spectrophotometry.

## **Molecular Biology and Biotechnology**

- DNA replication, transcription, and translation
- Gene regulation and expression
- Recombinant DNA technology, cloning, PCR
- Applications of biotechnology in agriculture, medicine, and industry