

# **Bhilai Mahila Mahavidyalaya, Bhilai Nagar, Bhilai**

## **(Under Graduate Courses )**

### **2.6.1 Program Outcomes, Program Specific Outcomes and Course Outcomes**

#### **B.Sc. (Maths Group) – 3 years Undergraduate programme**

##### **Programme Outcomes (PO) BSc Maths Paper**

**PO1.** The undergraduate programme in Mathematics / Physics / Chemistry is aimed at providing the students necessary inputs so as to set forth the task of bringing about new and innovative ideas/concepts so that the formulated model curricula in Mathematics / Physics / Chemistry becomes in tune with the changing scenario and incorporate new and rapid advancements and multi-disciplinary skills, societal relevance, global interface, self-sustaining and supportive learning.

**PO2.** It is desired that undergraduate programme in Mathematics / Physics / Chemistry besides teaching the basic concepts of Mathematics / Physics / Chemistry should in addition have broader vision for students so that the students therefore be exposed to societal interface of Mathematics / Physics / Chemistry and the role of Mathematics / Physics / Chemistry in the development of physical, chemical and mathematical sciences & technologies.

**PO3.** The students will be able to think critically and take informed decisions after identifying the accuracy and validity of their assumptions and ideas from intellectual, organizational, and personal perspectives

**PO4.** The students will be able to communicate effectively through speaking, reading, writing and listening clearly in one Indian language and thereby express themselves to the world by connecting with different ideas, books, people, media and technology.

**PO5.** The students will be able to interact socially and stimulate views, reconcile disagreements and help reach consensual conclusions.

**PO6.** The students will be able to demonstrate compassionate social concern and act with cognizant awareness of issues to contribute in civic life by volunteering impartially towards national development and thereby deliver effective citizenship.

**PO7.** The students will be able to ethically recognize different value systems, understand the moral dimensions of individual decisions and accept responsibility for them.

**PO8.** The students will be able to recognize the issues of environmental perspectives and appreciate sustainable development for long term environmental sustainability.

**PO9.** The students will be able to engage themselves in life-long self-determining and learning in the comprehensive background of socio-technological changes for continued self-directed and life-long.

## **Programme Specific Outcomes (PSO) BSc Maths Paper**

The course of B.Sc. First Mathematics has been divided into Three papers

### **PSO: 01- Paper-I: Algebra and Trigonometry**

- Gain knowledge of Elementary operation on Matrices, Inverse of Metrics.
- Able to solve Application of Matrices to a System of Linear Equation
- Solve Mapping, Equivalence Relation & Partition.
- Develop the knowledge for applying the concept of Group ,Ring & Fields
- Solve various problems on De-Moivre's Theorem and its Application.

### **PSO:02- Paper- II- Calculus**

- Verify the values of limit and Continuity of a function .Understand the Successive Differentiation, Leibnitz's Theorem, Macluarin and Taylor's Series Expansion
- Learn the method and properties of Asymptotes and Curvature.
- Students will be familiar with the techniques of Integral Calculus.
- Identify types of differential equations and solve differential equations such as Exact, homogeneous, non-homogeneous, and linear and Bernoulli differential equations etc.
- Solve various problems on Ordinary Differential Equation.

### **PSO: 03-Paper- III- Vector Analysis and Geometry**

- Understand basic notions of Scalar and Vector Product of three Vector.
- Able to solve Application of Green, Gauss and Stokes Theorem.
- Students will be familiar with the techniques of integral Calculus.
- Identify types of differential equations and solve differential equations such as Exact, homogeneous, non-homogeneous, and linear and Bernoulli differential equations etc.

• Solve various problems on Ordinary Differential Equation.The course of B.Sc. Second Mathematics has been divided into Three papers:

### **PSO: 04-Paper-I- Advanced Calculus**

- Solve the Convergence of Series and Sequences with Different Tests.
- Identify and apply the intermediate value theorem, Mean value theorem.

- Verify the values of limit of a function of Two Variable, Homogeneous Function and Taylor's Theorem for Function of two variables.
- Identify the Maxima and Minima of Function of Two and Three Variables.
- Learn the method and properties of Beta and Gamma Function, Double and Triple Integrals

#### **PSO: 05-Paper-II – Differential Equation**

- Students develop knowledge in the Bessel's and Legendre's Differential Equation.
- Learn the methods and properties of Laplace transform and Inverse Laplace Transform, apply them to solve Linear Differential Equations.
- Identify partial differential equations of the First order, Lagrange's Method and Charpit's Method.

Solve the partial Differential Equation of second and higher Order.

- Problem solving of Variational with fixed boundaries.

#### **PSO: 06-Paper-III – Mechanics**

- Solve the Analytics Condition of Equilibrium and virtual work, Catenary.
- Understand the force in three Dimensions, Null Lines and Dynamics.
- Solve various problems on Simple Harmonic Motion, Elastic Strings, Projectile and central orbits.
- Problem solving Kepler's Law of Motion, Velocity and acceleration in tangential.

#### **PSO: 07-Paper-I- Analysis**

- Solve the Series of arbitrary terms. Convergence, divergence and Oscillation. Abel's and Dirichlet's test. Multiplication of series.
- Determine the Riemann integrability, Intergrability of continuous and monotonic functions with Different Tests
- Understand Complex numbers as ordered pairs. Geometric representation of Complex numbers.
- Understand the Metric spaces, Neighbourhoods, Limit points, Interior points, Open and closed sets, Closure and interior.
- Learn the Dense subsets. Baire Category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem. Uniform continuity.

#### **PSO: 08-Paper-II- Abstract Algebra**

- Students develop knowledge of Group-automorphisms, inner automorphism. Automorphism groups and their computations, Conjugacy relation, Normaliser, Counting principle and Sylow's theorems, Sylow subgroup, Structure theorem for finite Abelian groups.

- Analyze and demonstrate examples of ideals and quotient rings and Use the concept of isomorphism and homomorphism for rings.
- Understand the vector spaces. Subspaces. Sum and direct sum of subspaces, linear span. Linear dependence, independence and their basic properties.
- Solve the Linear transformations and their representation as matrices
- Solve the Inner Product Spaces–Cauchy-Schwarz inequality and Bessel's inequality for finite dimensional spaces. Gram-Schmidt Orthogonalization process.

### **PSO: 09- Discrete Mathematics (II)**

- Gain knowledge Graph Theory-Definition of (Undirected) Graphs, Paths, Circuits, Cycles, and Subgraphs and Induced Subgraphs.
- Verify the Spanning Trees, Cut-sets, Fundamental Cut -sets, Cycle. Minimal Spanning Trees and Kruskal's Algorithm.
- Solve directed Graphs, In degree and Out degree of a Vertex, Weighted undirected Graphs and Dijkstra's Traversals.
- Understand Introductory Computability Theory-Finite State Machines and their Transition Table Diagrams

## **Course outcome(CO) BSc Maths Paper**

### **Course outcome(CO) BSc Maths Course 1: Algebra & Trigonometry**

**CO1.** The students after the completion of this course will be able to describe Group theory, Ring theory, Vector Space, Modules

**CO2.** The students after the completion of this course will be able to find the inverse of matrix, Canonical form and apply the Cayley – Hamilton theorem.

**CO3.** The students after the completion of this course will be able to describe that every problem can be solved as every theorem in Group theory and Ring theory has its proof and solution.

**CO4.** The students after the completion of this course will be able to apply de-moivre's theorem to solve related problems.

### **Course outcome(CO) BSc Maths Course 2: Calculus**

**CO1.** The students after the completion of this course will be able to test the continuity and differentiability of functions of one variable.

**CO2.** The students after the completion of this course will be able to calculate and solve the definite and indefinite integrals.

**CO3.** The students after the completion of this course will be able to find the Maclaurin and Taylor's series of functions at any value.

### **Course outcome(CO) BSc Maths Course 3: Vector Analysis & Geometry**

**CO1.** The students after the completion of this course will be able to determine & calculate vector and scalars, dot and cross products.

**CO2.** The students after the completion of this course will be able to solve and verify Gauss, Greens and Stokes theorem.

**CO3.** The students after the completion of this course will be able to solve Vector Integration and differentiation.

**CO4.** The students after the completion of this course will be able to describe Cone, Sphere, Cylinder, Generating Lines, Straight line, Plane etc.

### **Course outcome(CO) BSc Maths Course 4: Advanced Calculus**

**CO1.** The students after the completion of this course will be able to determine the series and alternating series. Different types of tests to solve the series

**CO2.** The students after the completion of this course will be able to determine Jacobian of two and three variables.

**CO3.** The students after the completion of this course will be able to find the limit of a function of one and two and test its continuity and differentiability.

**CO4.** The students after the completion of this course will be able to determine the Beta – Gamma functions and solve the double and triple integrations.

### **Course outcome(CO) BSc Maths Course 5: Differential Equations**

**CO1.** The students after the completion of this course will be able to solve the ordinary and partial differential equations.

**CO2.** The students after the completion of this course will be able to compute the Laplace and Inverse Laplace transformation of the given equation

**CO3.** The students after the completion of this course will be able to describe and solve differential equations.

### **Course outcome(CO) BSc Maths Course 6: Mechanics**

**CO1.** The students after the completion of this course will be able to find the velocity and acceleration of a moving particle.

**CO2.** The students after the completion of this course will be able to compute the equilibrium condition of particle.

**CO3.** The students after the completion of this course will be able to describe the attraction and potential of different particles (Moving and Static)

### **Course outcome(CO) BSc Maths Course 7: Analysis**

**CO1.** The students after the completion of this course will be able to determine the Fourier series of full and half range of any function of one variable.

**CO2.** The students after the completion of this course will be able to apply Schwarz and Young's theorem on various functions.

**CO3.** The students after the completion of this course will be able to analyze all type of trigonometric real functions.

### **Course outcome(CO) BSc Maths Course 8: Abstract Algebra**

**CO1.** The students after the completion of this course will be able to use various forms of "Sylow theorem" to identify the whole structure of group.

**CO2.** The students after the completion of this course will be able to analyze Groups, Sub-groups, Normal Sub-groups, and Semi-groups etc.

**CO3.** The students after the completion of this course will be able to determine inner product of two Vectors, and Inner product space.

**CO4.** The students after the completion of this course will be able to analyze Vector space, Ring, their types, modules, ideals etc.

### **Course outcome(CO) BSc Maths Course 9: Advanced Discrete Mathematics**

**CO1.** The students after the completion of this course will be able to describe Graphs, Trees, Spanning Trees, Circuits, finite state machine and their types.

**CO2.** The students after the completion of this course will be able to describe the difference between Mealy and Moore machine.

**CO3.** The students after the completion of this course will be able to compute the output of a finite state machine corresponding to their next state of the given input.

## **B.Sc. (Maths Group) – 3 years Undergraduate programme**

### **Programme Outcomes (PO) BSc. Physics Paper**

Physics deals with a wide variety of systems, certain theories are used by all physicists. Each of these theories were experimentally tested numerous times and found to be an adequate approximation of nature. Physics uses mathematics to organize and formulate experimental results. From these results, precise or estimated solutions, quantitative results from which new predictions can be made and experimentally confirmed or negated. The results from physics experiments are numerical measurements. Technologies based on mathematics, like computational physics is an active area of research. The course would empower

the students to acquire engineering skills and practical knowledge, theoretical basis for doing experiments in related areas, which help the students to gain basic knowledge for their higher studies.

## **Programme Specific Outcomes (PSO) BSc Physics Paper**

**PSO: 1** Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of Physics.

**PSO:2** Students will demonstrate knowledge of classical mechanics, electromagnetism and modern Physics and be able to apply this knowledge to analyze a variety of physical phenomena.

**PSO:3** Students will show that they have learned laboratory skills, enabling them to take measurements in a Physics laboratory and analyze the measurements to draw valid conclusions.

**PSO:4** Students will be capable of oral and written specific communication and will prove that they can think critically and work independently.

## **Course outcomes(CO) BSc. Physics Paper**

### **Course outcome(CO) BSc Maths B.Sc. Ist Year Physics (Paper-I)**

**CO1.** Students articulate the experience and understand basic physical fundamentals and key vocabulary to describe- Kinematics, Dynamics, Work and Energy. Introduction to the concept of centre of mass and conservation of energy.

**CO2.** Students develop the understanding of Rigid bodies and exhibit the differential equation and its solution for different cases. Example of simple harmonic oscillation:- Spring and Mass system, Simple and Compound Pendulum, Torsional Pendulum.

**CO3.** Students acquire the knowledge about Bifilar Oscillations and different harmonic oscillators. Case of different frequencies, transient and steady states, power absorption and response.

**CO4.** Students become aware of Accelerating charge field, transverse and longitudinal field in the direction perpendicular and parallel to each other. Velocity selector its resolution, elements of mass spectrography, principle of magnetic focussing lens.

**CO5.** Students articulate and understand the different aspects of elasticity and the parameters related to it. Learn the basic properties of matter, Young's Modulus and Rigidity Modulus and defines how they are evaluated for different shapes of practical relevance.

### **Course outcomes(CO) B.Sc. Ist Year Physics (Paper-II)**

**CO1.** Understand the motion of objects in different frames of reference. Understand the laws of motion, reference frames and its applications i.e. projectile motion, simple harmonic oscillator, Rocket motion, elastic and inelastic collisions.

**CO2.** Understand the idea of conservation of angular momentum, central forces and the effective potential. Understand the application of central force to the stability of circular orbits, Keplers laws of planetary motion, Orbital Precession and Rutherford Scattering.

**CO3.** Understand the dynamics of rotating objects i.e. rigid bodies, angular velocity, the moment of inertia, parallel axis theorem, the inertia tensor, the motion of rigid bodies, non- inertial frames: pseudo forces, examples involving the centrifugal force and coriolis force.

**CO4.** Understand the basics of material properties like elasticity, elastic constants and their relation, torsion of a cylinder, bending of a beam, cantilever, beam supported at its ends and loaded in the middle.

**CO5.** Understand the basics of motion of fluid which includes streamlined and turbulent flows, equation of continuity, critical velocity, flow of a liquid through a capillary tube, capillaries in series and parallel, Stoke's formula.

### **Course Outcomes(CO)B.Sc. IInd Year Physics (Paper-I)**

**CO1.** Students will develop the concept of Laws of Thermodynamics, the Zeroeth law, Carnots cycle, Carnots theorem. Change of entropy in (a) Isothermal Expansion (b) Reversible Isochoric Process (c) Free Adiabatic Expansion and concept of Entropy. Idea of thermodynamic functions, internal energy, Helmholtz function, Gibb's energy, Maxwells equation and application.

**CO2.** Students will understand Maxwell distribution of speed in an ideal gas, Doppler broadening, real gas, Critical constant

**CO3.** Students develop the concept of Statistical basis of thermodynamics, Probability Principle of equal prior probability, Gibb's ensemble, phase space, Boltzmann Canonical Law

**CO4.** Students become aware of polarisation by double refraction, Optical activity

**CO5.** Students develop the understanding about Laser system, basic properties, coherence length, time, Einstien's A & B coefficients, Spontaneous Emission, Types of Laser:- Ruby, He-Ne Laser and their applications.

### **Course Outcomes(CO)B.Sc. IInd Year Physics (Paper-II)**

**CO1.** Students develop the understanding of concept of waves, speed of transverse waves on uniform string, speed of longitudinal waves in a fluid, group velocity and phase velocity, reflection, refraction and diffraction of sound, principle of sonar system and sound ranging.

**CO2.** Students develop the ability to recognize Fermats principle of extremum path, the aplanatic points, Cardinal points, thick lens, aspherical mirror, meniscus lens, optical instruments, entrance and exit pupil, Ramsden and Huygen eyepiece.

**CO3.** Students learn and analyse interference of light, principle of superposition, thin film, Newtons ring, Michelson interferometer, Fabry- Perot, Rayleigh and Twynmann Green Interferometer and its uses.

**CO4.** Students understand the concept of diffraction, Fresnel, Fraunhofer diffraction, zone plates, diffraction grating, resolving power of optical instruments.

**CO5.** Students become aware of polarisation by double refraction, Optical activity



### **Course Outcomes(CO)B.Sc. IIIrd Year Physics (Paper-I)**

**CO1.** Students understand Reference system ,Inertial frames, Michelson-Morley experiment and concept of Theory of Relativity ,Lorentz transformations, length contraction, time dilation, velocity addition theorem and Compton effect.

**CO2.** Students develop the knowledge of –Origin of quantum theory, De-Broglie’s hypothesis for matter waves and the concept of wave and group velocities, experimental demonstration of matter waves.

**CO3.** Students understand the following terms –Schrodinger’s equation, Harmonic oscillator, Reflection at a step potential and the basic concept of Hydrogen atom and the related Physical quantities.

**CO4.** Students gain their knowledge about –Spectra of Hydrogen, double fine structure, Alkali spectra and their selection rules. Dissociation limit for ground and other electronic states. Concept of Raman effect, Stokes and anti-stokes lines.

**CO5.** Students develop the understanding of –Interaction of charged particles and neutrons with matter, working of nuclear detectors, GM counter ,spark chamber. Concept of structure of nuclei ,p-p and n-p scattering and general concept of nuclear forces. Nuclear reactions, fission and fusion concept.

### **Course Outcomes(CO)B.Sc. IIIrd Year Physics (Paper-II)**

**CO1.** Students become aware of-Amorphous and crystalline solids, crystal planes, Miller indices, Bonding in solids .Cohesive energy of solids, Madelung constant, specific heat of solids, Dispersion relation and Brillouin zone.

**CO2.** Students will develop – free electron model of a metal, solution of one dimensional schrodinger equation, Fermi energy, kroning -Penny model .basic concept of difference between metal, Insulator and semiconductors, Hall effect, Curie-Weiss’s law.

**CO3.** Students will understand- Intrinsic and extrinsic semiconductors, conceot of Fermi level, generation and recombination of electron and hole pairs in semiconductors, p-n junction diodes. Basic concept of Tunnel diode, Zener diode, Light emitting diode, Solar cell, FET and MOSFET.

**CO4.** Students learn and understand about- Half and Full wave rectifier, Bridge rectifier, filters, applications of transistors. Transistor as amplifier, transistor as oscillator, requirements of an oscillator, Wein- Bridge and Hartley oscillator.

**CO5.** Students acquire the knowledge about- Digital circuits, Number system, logic gates and concept of De- Morgans theorem, Boolean laws and Boolean Algebra, digital to analog and analog to digital converter.

## **B.Sc.- 3 years Undergraduate programme**

### **Programme Outcomes (PO) BSc. Chemistry Paper**

The motivation behind the under-graduate chemistry programme at the Department of Chemistry, Bhilai Mahila Mahavidyalaya, Bhilai Nagar is to give the crucial information and lab assets to get ready students for careers as specialists in the arena of chemistry. They will be capable to become as a chemists, as a

scientists, experts in various research laboratories and can seek after M.Sc. in Chemistry and after may go for pursuing Ph.D. programmes.

After successful completion of three year degree programme in Chemistry students should be able to

- Illustrate, address and a comprehension of significant ideas on the whole disciplines of chemistry.
- Take care of the issue and furthermore think systematically, freely and make a sensible inference.
- Utilize basic reasoning and the logical information to configuration, convey out, record and break down the consequences of substance responses.
- Make an attention to the effect of chemistry on the climate, society, and advancement outside mainstream researchers.
- Discover the green path for substance response for reasonable advancement. To instill the logical disposition in the students and outside mainstream researchers. Utilize current techniques, modern equipment's and chemistry software's.

### **Programme Specific Outcomes (PSO) BSc Chemistry Paper**

- Students will be able to gain the information on chemistry through theory as well as practical's. Able to understand good laboratory practices and safety. Develop research oriented skills.
- They will be able to elucidate nomenclature, stereochemistry, structures, reactivity, and mechanism of the different chemical reactions.
- Also they will learn to recognize chemical formulae and tackle mathematical issues.
- They will utilize current chemical instruments, Models, Chem-draw, Graphs and Equipment's.

### **Course outcomes (CO) B.Sc. Ist Year Chemistry (Paper-I) Inorganic Chemistry**

**CO1.** Understand the atomic structures and related rules, wave nature of atomic orbitals by Schrodinger Wave Equation, shapes of different atomic orbitals, general idea of quantum numbers, electronic configuration of the elements, filling of electrons in different orbitals by various rules like Aufbau and Pauli exclusion principles, Hund's Multiplicity rule, periodic properties of the elements such as ionization energy, electron gain enthalpy, electronegativity etc.

**CO2.** Understand the structures and features of ionic solids like radius ratio & co-ordination number different types of defects found in ionic solids, knowledge of Fajan's rule, dipole moment, semiconductors and its theories.

**CO3.** Understand the covalent bond and its properties, know the limitations of VBT, Concept of hybridization, understand the VSEPR theory to find out the geometry and shapes of different molecules, application of molecular orbital theory to construct the MOT diagram of different diatomic and simple polyatomic molecules.

**CO4.** Know the general concepts of methods of preparation, silent features, physical & chemical properties, structure and bonding of s and p block element and their compounds, understand the diagonal relationship.

**CO5.** Understand the chemistry of noble gases, basic idea of quantitative analysis of inorganic mixtures, removal of interfering inorganic radicals.

### **Course Outcomes(CO)B.Sc. Ist Year Chemistry (Paper-II) Organic Chemistry**

**CO1.** Know the knowledge of different electronic displacement, idea about bond cleavage, formation, structures, and properties of different intermediates, distinguish electrophiles & nucleophiles, and three types of organic reactions such as Addition, Elimination and Substitution reactions.

**CO2.** Gain comprehensive knowledge about optical & geometrical isomerism, concepts of chiral molecule, Enantiomers, Diastereoisomers, meso- compounds different types of representation/configuration of organic molecules, CIP rules.

**CO3.** Gain insight knowledge of conformational analysis of alkanes, ethane, butane, cyclohexane and sugars, learn relative stability of different types of cycloalkanes, Chair, Boat and Twist boat conformation of cyclohexane with energy diagrams.

**CO4.** Understand the detail knowledge of formation, structures, preparation methods, physical & chemical properties, specific chemical reactions, and their mechanism of alkanes, alkenes and alkynes.

**CO5.** Understand the complete knowledge of formation, structures, preparation methods, physical & chemical properties, specific chemical reactions, their mechanism of aromatic compounds, concepts of Huckel's rule.

### **Course Outcomes(CO)B.Sc. Ist Year Chemistry, Paper III Physical Chemistry**

**CO1.** Understand different mathematical concepts, learn permutation and combination and Probability theory, learn importance of significant figures and their applications.

**CO2.** Understand the comprehensive knowledge of ideal and real gases, importance of Maxwell distribution law and its use in evaluating molecular velocities, concepts of Joule Thomson effect and its application in liquification of gases, deviation of Deviations from ideal gas behaviour, compressibility factor (Z), and its variation, general idea of van der Waals equation of state.

**CO3.** Understand the structure & Properties of liquids, general concepts of viscosity and surface tension, detail concepts of adsorption and its properties, different types of adsorption isotherms, meaning of colloidal state.

**CO4.** Learn about the elementary ideas of symmetry, symmetry elements and symmetry operations in solid compounds, types of crystal defects, X-ray diffraction, Bragg's law.

**CO5.** Write an expression for rate constant K for zero, first and second order reaction and solve the numerical problems based on Rate constant, importance of catalysts.

## Laboratory Course

Learn and understand the basic concepts of quantitative analysis of inorganic acidic & basic radicals and organic functional groups, handling the viscometer & stalagmeter.

### Course outcomes (CO) B.Sc. II<sup>nd</sup> Year Chemistry (Paper-I) Inorganic Chemistry

**CO1.** Learn the basic knowledge of electronic configuration, silent features, oxidation states relative stability and magnetic properties of 3d elements.

**CO2.** Learn the spectral properties, magnetic behaviour, stereochemical features of 4d and 5d elements.

**CO3.** Understand the basic concepts of redox reactions, know the meaning of various terms involved in coordination chemistry, to understand Werner's formulation of complexes and identify the types of valences.

**CO4.** Know the electronic configuration, isolation and extraction of compounds of lanthanides and actinides.

**CO5.** Understand the difference between acids & bases and application of different non aqueous solvents.

### Course outcomes (CO) B.Sc. II<sup>nd</sup> Year Chemistry (Paper-II) Organic Chemistry

**CO-1.** Understand the detail knowledge of formation, structures, preparation methods, physical & chemical properties, specific and important chemical reactions, their mechanism of alcohols, phenols, ethers and epoxides.

**CO-2.** Learn the deep knowledge of formation, structures, preparation methods, physical & chemical properties, specific chemical reaction, and their mechanism with its application of aldehydes and ketonic compounds.

**CO-3.** Understand the detail knowledge of formation, structures, preparation methods, physical & chemical properties, acidic behaviour, specific chemical reactions, and their mechanism of carboxylic acids and its derivatives.

**CO4.** Gain deep and detail knowledge of formation, structures, preparation methods, physical & chemical properties, basic behaviour, specific chemical reaction, their mechanism of aliphatic and aromatic nitro compounds.

**CO5.** Understand the detail knowledge of formation, structures, preparation methods, physical & chemical properties, specific chemical reaction, and their mechanism of different heterocyclic compounds. Also learn about the structure, stereochemistry, and features of amino acids, proteins and nucleic acids.

### Course outcomes (CO) B.Sc. II<sup>nd</sup> Year Chemistry (Paper-III) Physical Chemistry

**CO1.** Gain deep knowledge of first law of thermodynamics, Joule-Thompson law, Hess's law and its application in different types of chemical reactions.

**CO2.** Understand the second law of thermodynamics, derive the Carnot Theorem, solve numerical problems of entropy, and learn variation of Gibbs Free Energy and Helmholtz Free Energy with pressure,

volume and temperature.

**CO3.** Understand the basic terminology of phase equilibria, draw the phase diagram of different component system, learn azeotropic mixtures and its application in daily life, understand the Nernst distribution law and its application in separation techniques.

**CO4.** Understand the electrolytic cell reactions, difference between strong and weak electrolytes, different theories of dissociation of electrolytes, solve numerical problems of transport numbers, learn different types of titrations based on conductance.

**CO5.** Learn the electrochemical cell reactions, write the expression of cell reactions, different types of reversible electrodes, solve the numerical problems of EMF, pH, pKa, understand the buffer solutions and its mechanism, salt hydrolysis and basic knowledge of corrosion.

### **Course outcomes (CO) B.Sc. IIIrd Year Chemistry (Paper-I) Inorganic Chemistry**

**CO1.** Understand the inner and outer orbital metal complexes according to VBT & CFT and application of CFSE values. Learn filling of electrons in d-orbital according to CFSE values. Understand the thermodynamic and kinetic stability of metal complexes.

**CO2.** Gain detail knowledge of magnetic behaviour of transition metal complexes, concepts of L-S coupling, Orgel energy level diagram and electronic spectrum of titanium complex.

**CO3.** Understand the detail knowledge of structures, preparation methods, physical & chemical properties, bonding, specific and important chemical reactions, and their mechanism of compounds of metals with organic ligands.

**CO4.** Importance of elements in biological processes, learn about structure & functions of hemoglobin and myoglobin, learn about conversion mechanism of atmospheric nitrogen in ammonia by nitrogen fixation.

**CO5.** Understand the basic concepts and applications of HSAB, structures, preparation methods, physical & chemical properties, bonding of silicones and phosphazenes.

### **Course outcomes (CO) B.Sc. IIIrd Year Chemistry (Paper-I) Organic Chemistry**

**CO1.** Understand the detail knowledge of formation, structures, preparation methods, physical & chemical properties, bonding, specific and important chemical reactions, and their mechanism of organic compounds of Mg, Zn, S and learn the acidic behaviour of enolates.

**CO2.** Gain detail knowledge of structure, configuration, inter conversion of different carbohydrates and learn the mechanism of osazone formation.

**CO3.** Gains the knowledge of synthetic polymers and synthetic dyes, their types, formation, properties, structures and uses.

**CO4.** Understand the basic concepts of spectroscopy, learn the Beer- Lambert's law, understand the principles of IR & UV spectroscopy, selection rules, learn the IR spectra of different organic compounds, and solve the numerical problems related to IR & UV spectra.

**CO5.** Understand the basic principle of NMR spectroscopy, and their applications, learn the interpretation of structure of organic compounds by given spectral data.

## **Course outcomes (CO) B.Sc. IIIrd Year Chemistry (Paper-I) Physical Chemistry**

**CO1.** Derive Schrodinger's wave equations, understand concepts of blackbody radiations, De-Broglie hypothesis, Uncertainty principle, learn the application of Schrodinger's wave equations for particle in 1-D box and H-atom, and solve numerical problems related to 1-D box.

**CO2.** Understand the basic ideas of molecular orbital theory, learn applications of LCAO, and calculate the coefficients of hybrid orbitals, formation of H<sub>2</sub> molecules by VBT.

**CO3.** Understand the basic principles of rotational, vibrational and Raman spectroscopy, their selection rules and applications.

**CO4.** Understand the different electronic transitions, law of photochemistry, learn the interpretation of Jablonski diagram, quantum yields.

**CO5.** Understand the basic knowledge of solutions, colligative properties of solutions, abnormal molecular mass, dipole moment, magnetic behaviour of substances, and solve the numerical problems related to solutions.

## **Laboratory Course**

Learn and understand the preparations of inorganic and organic compounds, separate, identified and systemic analyses two organic compounds, handling instruments like colorimeter, polarimeter.

## **B.Sc.- 3 years Undergraduate programme**

### **Programme Outcomes (PO) BSc. Computer Science**

The under-graduate programme is aimed at making student capable of comprehending able to analyze simple as well as complex situations involving application of scientific concepts in real life situations. B.Sc. graduates would apply their expansive knowledge of science over a scope of fields, with inside and out learning in at least one field of discipline of their studies, while exhibiting a comprehension of the nearby and worldwide settings in which science is rehearsed. A science graduate is expected to articulate the methods of science and explain why current scientific knowledge is both contestable and testable by further inquiry. Develop the skill and ability to apply and understand the principles of various disciplines objectively, creatively and through independent thinking. Apply appropriate methods of research, investigation and design, to solve problems in science. A science graduate would be competent and independent enough for further studies within the field, can work in an autonomous and sorted out way, set objectives for specified work, devise a work routine and tail it.

## **Programme Specific Outcomes (PSO) BSc. Computer Science**

**PSO1.** Demonstrate mastery of Computer Science in the following core knowledge areas

- Programming Languages
- Databases,
- Computer Hardware and Architecture

**PSO2.** Apply problem-solving skills and the knowledge of computer science to solve real world problems.

**PSO3.** Develop technical project reports and present them orally among the users

## **Course outcomes (CO) B.Sc. Ist Year Computer Science**

### **Course Outcomes: C Programming**

CO1. Before implementation of any program, student has to learn about the program logic by using program development tools like algorithm, flowcharts and pseudo code. We taught students by taking real life examples about algorithm, flowcharts and pseudo code. Now our students have learnt how to develop the logic of the program.

CO2. Once the algorithm/ flowchart/pseudo code part is over, the student has to implement the program code by understand the defining of variables, data types, control statements like if, while, do-while, for, switch etc. statements. They have to also type & run the program on computer. Now all the students have learnt how to write and execute the program.

CO3. The students have to learn about efficiency of program by understanding derived data types (array, string, function, pointers) and user-defined data types (structure, union). Students were efficiently writing the programs using derived and user-defined data types to save program execution time and memory.

### **Course Outcomes: Computer Fundamentals**

CO1. Bridge the fundamental concepts of computers with the present level of knowledge of the students

CO2. Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming

CO3. Familiarise operating systems, programming languages, peripheral devices, networking, multimedia and internet

CO4. Understand binary ,octal and hexadecimal number systems and their arithmetic

CO5. Students will be able to solve problems based on Proposition, Predicates and Logic. Logic topic will help them a lot in Digital Electronics which they will be learning in further semester.

CO6. Students will be able to perform various operations based on Sets theory.

CO7. To understand and solve the problems related to relations and functions.

CO8. To Comprehend with Group, Lattices and its Properties.

CO9. Students will be able to solve problems on graph theory .the Graph theory has application in various field of computer science like, Computer Graphics ,Data Structure, Artificial Intelligence etc. All these Topics will help the students to understand various important concepts of other subject of the course in higher studies.

## **Course outcomes (CO) BSc. Computer Science Part-II**

### **Course Outcomes: Object Oriented Programming in C++**

CO1. C++ is superset of C language. It provides the data hiding feature. Students learned the difference between C and C++. They also learn the features of OOP like classes, objects, data abstraction & encapsulation, inheritance, polymorphism, message passing & dynamic binding etc.

CO2. Students learned about program writing using concept of OOP by taking the example of real life applications. They also learned how to protect data from outside world using different types of visibility labels and converting C programs into C++ program.

CO3. When the exception is raised, program is abnormally terminated. For handling such exceptions during the execution of program, students have learned exception handling model.

## **Course outcomes (CO) BSc Computer Science Part-III**

### **Course Outcomes::Visual Basic Programming**

CO1. Students acquired the skills and knowledge required to use essential features and capabilities of Visual BASIC, a programming system used to produce Graphical User Interfaces and applications in a Windows environment.

CO2. Students studied basic programming concepts, problem solving, programming logic, and the design of event-driven programming.

CO3. Develop and debug applications using Visual Basic Programming that runs under Windows operating system.

### **Course Outcomes: DBMS**

Upon the successful completion of this course, Student will be able to

CO 1. To analyze data base design methodology.

CO 2. Acquire Knowledge in Fundamental of data base management system.

CO 3. Analyze the difference between the traditional file system and DBMS.

CO 4. Handle with different data base languages.

CO 5. Draw various data model using ER modeling for real life applications along with that they will be able to construct queries mathematically through relational algebra.

CO 6. Understand the underlying concept of database technique.



CO 7. Design and implementation of data base schema for a given problem domain.

CO 8. Students will be able to handle with different database languages.

CO 9. Students will be able to deal with Table, View, Procedures, Functions, Triggers.

CO 10. Introduction to different database packages (Oracle/MYSQL/DB 2 etc).

CO 11. Students will be able to use data base connectivity as front end.

CO 12. By the end Students will be able create projects.

## **B.Sc. (Biology Group) – 3 years Undergraduate programme**

### **Programme Outcomes (PO) BSc Biology( Paper Botany)**

**BSc Biology:-** B.Sc.Biology is a three-year course. One study a diverse range of subjects in these years. For the most part in the curriculum, biological aspects of the living are taught. Subjects range from Zoology, Molecular biology, Ecology, Botany, Microbiology to Genetics. There are a lot of fields open for an undergraduate, Also with recent developments in Biology, the area of work has expanded multi-folds. BSc Biology degree serves as a basis for higher studies in this field such as MSc in various subjects, PhD and MPhil degree in subjects such as Botany, Zoology, Bio-Chemistry, Biotechnology, Food Science, Biomedical Sciences, Genetics, Molecular Biology, Microbiology, Environmental Sciences, Virology, Toxicology etc. The subject also has plenty of opportunities in the field of Research and Development (R&D), Pharmaceuticals and Chemical industries, Public Health and Environmental Protection Sectors, Clinical Research, Waste Management, etc.

**Subjects covered under BSc Biology** (Biogeography, Advanced Cell Biology, Advanced Molecular Genetics, Advanced Topics, Plant physiology,Basic Plant Pathology, Biostatistics, Conservation Ecology, Developmental Biology, Ecology and Environment, Community Ecology, Evolution and Systematics, Mycology,Plant Tissue Culture,Virology)

PO1. Students knows about Biodiversity of plant and its importance in the maintenance of environment.

PO2. Students learn to carry out practical work, in the field and in the laboratory, interpreting plant morphology and anatomy, Plant identification, Vegetation analysis techniques.

PO3. Apply the knowledge of basic science, life sciences and fundamental process of plants.

PO4. Apply modern techniques and instruments for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological studies of plants with an understanding of the applications in human life.

PO5. Apply the knowledge gained from the studies for the upliftment of society via addressing health, environmental issues, food scarcity, genetic engineering, plant biotechnology, plant pathology etc.

PO6. It enhances skills in handling scientific instruments, planning and executing biological research.

### **Programme specific outcomes of BSc. Botany Paper**

1. BSc. Botany students Acquire fundamental knowledge about Botany through theory, practical's experiments and analyzing experimental data.

2. They acquire fundamental knowledge about Cytology and they develop strong fundamentals basics for further cytological studies. Paper provide a foundation and background in cellular structure of plants cell structure in relation to functions, eukaryotic genome structure (including nuclear and organellar), and regulatory mechanisms.

3. They acquire fundamental knowledge about Genetics and inheritance various life forms genome replication, maintenance, function and regulation of expression.

4. They acquire fundamental knowledge and understand about Lower plants their classification, structure, growth reproduction and life history.

5. They acquire fundamental knowledge and understand Bryophyte, Pteridophyta and Gymnosperm their classification, structure, growth reproduction and life history.

6. They acquire fundamental knowledge and understand Taxonomy and diversity of plants their Description, Identification, Nomenclature and their classification including recent advances in the field.

7. The students will be learn about protein, RNA, cell being the basic unit of life or higher plants and current state of knowledge about the plant cell structure and their turn over, starting from cell wall to chromatin, in relation to their functions.

8. They acquire fundamental knowledge and understand principles and various physiological life processes in plants. They will also gain about the various uptake and transport mechanisms in plants and are able to coordinate the various processes. They understand the role of various hormones, signaling compounds, thermodynamics and enzyme kinetics.

9. They acquire fundamental knowledge and understand the essentials of Plant metabolism, photosynthesis, respiration and nitrogen metabolism.

10. They acquire fundamental knowledge and understand the essentials of Plant development and plant resources.

11. Students acquire fundamental knowledge and understand the principles, essentials and fundamentals of Plant Ecology, Ecosystem and vegetation ecology, population, community and ecosystem structure and function, application of these concepts to solve environmental problems, strategies for conservation, biological diversity, conservation, sustainable development.

12. They acquire fundamental knowledge and understand essentials of principles of Biotechnology I (Genetic engineering of plants & microbes), and Scope of Biotechnology, recombinant DNA technology and modern age applications of recombinant DNA technology, Concepts, tools and techniques related to in vitro propagation of plants, Different methods used for genetic transformation of plants, use of Agrobacterium as a vector for plant transformation, components of a binary vector system.

13. Student will develop the understanding of plant reproduction. Pollination, Fertilization, Embryogenesis, Aeropallinology are the areas which are stressed upon.

## **Course outcome(CO) Botany, BSc. Part I Paper 1:- General diversity of microbes and cryptogams**

**CO1: Virus:** The First year Botany students after the completion of this course will be able to understand and describe about General characteristics; types of viruses based on structure and genetic material; multiplication of viruses (General account); Lytic and Lysogenic cycle; Economic importance; Structure and multiplication of Bacteriophages; General account of Viroids; Viroids; Prions and Cynophases ; Mycorrhiza-Types and significance.

**CO2: Bacteria:** The First year Botany students after the completion of this course will be able to understand and describe about General characteristics and classification (on the basis of morphology), Fine structure of bacterial cell, Gram positive and Gram negative bacteria; Mode of nutrition and reproduction vegetative, asexual and recombination (Conjugation, transformation and transduction; Economic importance; Microbial Biotechnology, *Rhizobium* , *Azotobactor*, *Anabena*.

**CO3:Fungi:** The First year Botany students after the completion of this course will be able to understand and describe about (range of Thallus organization), cell wall composition, nutrition and reproduction in Fungi; Heterothallism and Parasexuality; Outlines of classification of Fungi; Economic importance of Fungi; Life cycles of *Saprotrgnia*; *Albugo*; *Aspergillus*; *Peziza*; *Agaricus*; *Ustilago*; *Puccinia*; *Alternaria* and *Cercospora*; VAM Fungi.

**CO4:Algae:** The First year Botany students after the completion of this course will be able to understand and describe about Algae: General characters, range of Thallus organization Gaidukov phenomenon; reproduction; life cycle pattern and economic importance; Classification, systematic position, occurrence; structure and life cycle of following genera; *Nostoc*; *Gleocapsa*; *Volvox*, *Oedogonim*, *Vaucheria*; *Chara*, *Ectocarpus*; *Polysiphonia*

**CO5:Lichen:** The First year Botany students after the completion of this course will be able to understand and describe about General account; types; structure; nutrition; reproduction and economic importance; Mycoplasma; Structure and importance; Blue green Algae ( BGA) in nitrogen economy of soil and reclamation of usar land, Mushroom technology.

## **Course outcome(CO) Botany, BSc. Part I Paper II :-Bryophytes, Pteridophytes, Gymnosperms and Paleobotany**

**CO1. Bryophyta:** The First year Botany students after the completion of this course will be able to understand and describe about General characteristics; affinities; range of Thallus organization; General Classification and economic and ecological importance ;systematic position; occurrence; morphology; anatomy and reproductive structure in *Riccia*; *Marchantia*; *Funaria*; Vegetative reproduction in Bryophytes; Evolution of sporophytes.

**CO2. Pteridophyta:** The First year Botany students after the completion of this course will be able to understand and describe about General characteristics; affinities; economic importance and classification; Heterospory and seed habit; stellar system in Pteridophytes; Apospory and apogamy; Telome theory; *Azolla* as Biofertilizer

**CO3.** The First year Botany students after the completion of this course will be able to understand and describe about Systematic position; occurrence; morphology; anatomy; and reproductive structure of *Psilotum*, *Lycopodium*, *Sleginella*, *Equisetum*, *Marselia*

**CO4. Gymnosperm:** The First year Botany students after the completion of this course will be able to understand and describe about General characteristics; affinities; economic importance and classification; morphology, anatomy and reproduction in *Cycas*, *Pinus* and *Ephedra*

**CO5. Palaeobotany:** The First year Botany students after the completion of this course will be able to understand and describe Geological time scale; types of fossils and fossilization; *Rhynia* study of some fossile Gymnosperm; *Lygenopteris*

### **Course outcome(CO) Botany, BSc. Part II Paper I Course:- Diversity of Seed Plants and their Systematics**

**CO1.** The Second year Botany students after the completion of this course will be able to understand and describe about characteristics of seed plants; evolution of the seed habit; seed plants with (angiosperms) and without (gymnosperms) fruits; fossil and living seed plants, general features of gymnosperms and their classification; evolution and diversity of gymnosperms; geological time scale, fossilization and fossil gymnosperms.

**CO2.** The Second year Botany students after the completion of this course will be able to understand and describe morphology of vegetative and reproductive parts; anatomy of roots, stem and leaf, reproduction and life cycle of *Pinus*, *Cycas* and *Ephedra*.

**CO3.** The Second year Botany students after the completion of this course will be able to understand and describe angiosperms: origin and evolution, some examples of primitive angiosperms, angiosperms taxonomy: brief history, aims and fundamental components; identification, keys taxonomic literature, botanical nomenclature: principles and rules; taxonomic ranks; type concept; principle of priority.

**CO4.** The Second year Botany students after the completion of this course will be able to understand and describe classification of angiosperms; salient features of the systems proposed by Bentham and Hooker and Engler and Prantl, major contributions of cytology, phytochemistry and taxometrics to taxonomy.

**CO5.** The Second year Botany students after the completion of this course will be able to understand and describe diversity of flowering plants: general account of the families- Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Liliaceae and Poaceae.

### **Course outcome(CO) Botany, BSc. Part II Paper II Course:-Structure Development and Reproduction in Flowering Plants**

**CO1.** The Second year Botany students after the completion of this course will be able to understand and describe the basic body plan of a flowering plant: modular type of growth, diversity in plant form in annuals, biennials and perennials; convergence of evolution of tree habit in gymnosperms, monocotyledons and dicotyledons; trees-largest and longest-lived organisms.

**CO2.** The Second year Botany students after the completion of this course will be able to understand and describe the shoot system: the shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; formation of internodes, branching pattern; monopodial and sympodial growth canopy architecture; cambium and its functions; formation of secondary xylem, a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; role of woody skeleton; secondary phloem – structure, function, relationships, periderm.

**CO3.** The Second year Botany students after the completion of this course will be able to understand and describe leaf: origin, development, arrangement and diversity in size and shape; internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission, the root system: the root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

**CO4.** The Second year Botany students after the completion of this course will be able to understand and describe flower: a modified shoot; structure, development and varieties of flower, functions, structure of anther and pistil, the male and female gametophytes; types of pollination; attractions and rewards for pollinators; pollen-pistil interaction, self incompatibility, double fertilization, formation of seed-endosperm and embryo; fruit development and maturation.

**CO5.** The Second year Botany students after the completion of this course will be able to understand and describe significance of seed: suspended animation; ecological adaptation; unit of genetic recombination and replenishment, dispersal strategies, vegetative reproduction: vegetative propagation, grafting, economic aspects.

### **Course outcome(CO) Botany, BSc. Part III Paper I Course:-Plant Physiology, Biochemistry and Biotechnology**

**CO1.** The Final year Botany students after the completion of this course will be able to understand and describe plant-water relations: importance of water to plant life; physical properties of water; diffusion and osmosis; absorption, transport of water and transpiration; physiology of stomata, mineral nutrition: essential macro and micro-elements and their role; mineral uptake; deficiency and toxicity symptoms.

**CO2.** The Final year Botany students after the completion of this course will be able to understand and describe transport of organic substances: mechanism of phloem transport; source-sink relationship; factors affecting translocation, basic of enzymology: discovery and nomenclature; characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and cofactors; regulation of enzyme activity, mechanism of action, photosynthesis: significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photo-phosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration.

**CO3.** The Final year Botany students after the completion of this course will be able to understand and describe respiration: ATP - the biological energy currency; aerobic and anaerobic respiration; Krebs's cycle, electron transport mechanism (chemi-osmotic theory); redox potential; oxidative phosphorylation; pentose phosphate pathway, Nitrogen and lipid metabolism: Biology of nitrogen fixation; importance of nitrate reductase and its regulations; ammonium assimilation; structure and function of lipids; fatty acid biosynthesis; Betaoxidation; saturated and unsaturated fatty acids; storage and mobilization of fatty acids.

**CO4.** The Final year Botany students after the completion of this course will be able to understand and describe growth and development: definitions; phases of growth and development; kinetics of growth, seed dormancy, seed germination and factors of their regulation; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; biological clocks; physiology of senescence, fruit ripening; plant hormones auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their discovery, biosynthesis and mechanism of action; photomorphogenesis; phytochromes and cryptochromes, their discovery, physiological role and mechanism of action.

**CO5.** The Final year Botany students after the completion of this course will be able to understand and describe genetic engineering: tools and techniques of recombinant DNA technology; cloning vectors; genomic and cDNA library; transposable elements; techniques of gene mapping and chromosome walking, biotechnology: functional definition; basic aspects of plant tissue culture; cellular totipotency, differentiation and morphogenesis; biology of Agrobacterium; vectors for gene delivery and marker genes; salient achievements in crop biotechnology.

### **Course outcome(CO) Botany, BSc. Part III Paper II Course:-Ecology and Utilization of Plants**

**CO1.** The Final year Botany students after the completion of this course will be able to understand and describe plants and environment: atmosphere (gaseous composition), water (properties of water cycle), light (global radiation, photosynthetically active radiation), temperature, soil (development, soil profiles, physico-chemical properties), and biota, Morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes), temperature (thermoperiodicity), light (photoperiodism, heliophytes and sciophytes) and salinity.

**CO2.** The Final year Botany students after the completion of this course will be able to understand and describe community ecology: community characteristics, frequency, density, cover, life forms biological spectrum; ecological succession, ecosystems: structure, abiotic and biotic components; food chain, food web, ecological pyramids, energy flow; biogeochemical cycles of carbon, nitrogen and phosphorus.

**CO3.** The Final year Botany students after the completion of this course will be able to understand and describe population ecology: growth curves; ecotypes; ecads, biogeographical regions of India, Vegetation types of India: Forests and grasslands.

**CO4.** The Final year Botany students after the completion of this course will be able to understand and describe utilization of plants food plants: rice, wheat, maize, potato, sugarcane, fibers: cotton and jute, vegetable oils: groundnut, mustard and coconut, general account of sources of firewood, timber and bamboos.

**CO5.** The Final year Botany students after the completion of this course will be able to understand and describe Spices, Medicinal plants, Beverages- Tea and coffee, Rubber

**Bachelor of Commerce (Three Years Degree Programme)  
Courses offered: B.COM. Plain and B .COM. with Computer**

## Programme Outcome (PO) B.COM. Plain and B .COM. with Computer Applications

PO1	After three years Degree course (Bachelor of Commerce) commerce graduate would gain knowledge of financial, commercial and managerial aspects of business and administration.
PO2	The all inclusive outlook of the course offers a number of value based and job oriented courses ensuring that students are professionally trained.
PO3	After completion of degree students will be productive workplace communicators.
PO4	To acquaint the students about corporate and business laws.
PO5	After completion of degree a commerce graduate will be a problem solver.
PO6	After completion of this degree a female commerce graduates can be a good woman entrepreneur.
PO7	To prepare students to exploit opportunities being newly created in the accounting and finance world.
PO8	After completion of this degree students recognise and understand the ethical responsibilities of individuals and organisations in society.
PO9	Commerce graduates have basic knowledge of mathematical and statistical tools of analysis.
PO10	After learning computer application as an additional paper students are proficient in the use of appropriate information technologies.

### Programme Specific Outcome B.Com. Ist year

PSO1	Financial Accounting	It enables to students to study about basic accounting knowledge as applicable to business.
PSO2	Business Communication	It enables to students to study about effective business communication skills.
PSO3	Business Mathematics	It enables the students to study about minimum knowledge of mathematics as applicable to business.
PSO4	Business Regulatory Framework	It enables to students to study about the Framework of Indian Business Laws.
PSO5	Business Environment	It enables to students to study about emerging issues in business at National and International level in the light of the policies of liberalization and globalization.
PSO6	Business Economics	It enables to students to study about Business Economics applicable in Business.
PSO7	Computer application	It enables to students to study about fundamentals of computers.
PSO8	Computer application	It enables to students to study about Ms Word, Excel and PowerPoint etc.

### Programme Specific Outcome B .Com. IInd year

PSO1	Corporate Accounting	It enables to students to study about important knowledge of preparing accounts of corporation from their incorporation to their liquidation.
PSO2	Company Law	It enable to students to study about basic knowledge of the provision of Companies Act 2013 along with relevant case laws.

PSO3	Cost Accounting	It enables students to study about basic concept and tools used in cost accounting.
PSO4	Principles of Business Management	It enables students to study about basic of Principles of Management.
PSO5	Business Statistics	It enables students to study about Statistical Techniques which are applicable to business.
PSO6	Fundamental of Entrepreneurship	It enables students to study about Entrepreneurial culture and Industrial growth so as to prepare them to set up and manage their own small business.
PSO7	Internet Application & E-Commerce	It enables students to study about Internet application and E-Commerce.
PSO8	Relational Database Management System	It enables students to study about Relational Database Management System.

### Programme Specific Outcome B.Com. IIIrd year

PSO1	Income Tax Act	It enables students to study about basic of Income Tax Act and its implications.
PSO2	Auditing	It enables students to study to understand the necessary procedure of Auditing and their applications.
PSO3	Indirect Tax with GST	It enables students to study about basic knowledge of Indirect Tax and GST with various applications.
PSO4	Management Accounting	It enables students to study about application of Accounting Techniques for Management.
PSO5	Financial Management	It enables students to study about conceptual framework of Financial Management.
PSO6	Financial Market Operations	It enables students to study about the transactions of Financial Market and the ways Market is being controlled and regulated.
PSO7	Programming In Visual Basic	It enables students to study about programming in Visual Basic.
PSO8	System Analysis, Design & MIS.	It enables students to study about System Analysis, Design and MIS.

### Course outcome(CO) B.COM Ist year

Financial Accounting	CO1	Course is mainly designed to share the knowledge of Basic Accounting Principles, Accounting Standards and Accounting Transactions.
	CO2	To provide working knowledge of Final Accounts with various adjustment entries.
	CO3	To provide practical knowledge and basic concepts of charging Depreciation and how to maintain Accounting Records in Non-Trading Institution.
	CO4	To impart the knowledge of Higher purchase and instalment system.
	CO5	To give practical knowledge of Dissolution of a Partnership Firm and Conversion of Partnership Firm into Joint Stock Company.
Business Communication	CO1	To provide the knowledge of concept of Business Communication.
	CO2	To provide the knowledge of corporate communication skills used in business.
	CO3	To provide the knowledge of writing skills used in business.



	CO4	To provide the knowledge of report writing and their presentation.
	CO5	To provide the knowledge of non-verbal aspects and Modern Forms of Communication.
Business Mathematics	CO1	To provide the knowledge of Simultaneous Equation and Linear Programming.
	CO2	To provide the knowledge of Matrices and Determinants.
	CO3	To provide the knowledge to apply the Principles of Simple Interest to solve relevant problems in financial applications such as simple interest based loans.
	CO4	To provide the knowledge of Ratio and Proportion, average and percentage applicable in business.
	CO5	To provide the knowledge of Commission, Brokerage Discount, Profit and Loss, transportation problems applicable in business.
Business Regulatory Framework	CO1	To acquire the knowledge of Indian Contract Act.
	CO2	To familiarize the discharge of duties by parties in Indemnity, Guaranty, Bailment and Pledge.
	CO3	To acquire the knowledge of the legal provision of Sale of Goods Act.
	CO4	To acquire the brief knowledge of Indian Negotiable Instruments Act.
	CO5	To acquire the knowledge of The Consumer Protection Act and Intellectual Property Rights Act.
Business Environment	CO1	To impart the knowledge of Business Environment and Economic Trends.
	CO2	To provide the knowledge regarding the problems of growth like Unemployment, Poverty, Regional Imbalances etc, which were faced in Economic Development.
	CO3	To provide the knowledge of role played by Government for economic development.
	CO4	To provide the knowledge of Economic Planning in INDIA.
	CO5	To provide the knowledge of International Environment.
Business Economics	CO1	To provide the knowledge of Micro and Macro Economics.
	CO2	To provide the knowledge of Law of Demand and its effecting factors .
	CO3	To provide the knowledge of Production functions.
	CO4	To provide the knowledge of Market Structure.
	CO5	To provide the knowledge of Theory of Distribution, Wages, Profit, Rent, Interest etc.
Computer Fundamentals	CO1	To provide the basic knowledge of Computer system.
	CO2	To provide the basic knowledge of Computer Peripherals.
	CO3	To provide the basic knowledge of components and storage.
	CO4	To provide the basic knowledge of Computer Software and languages.
	CO5	To provide the basic knowledge of introduction to MS-DOS and Windows.
PS SW & MM	CO1	To provide the knowledge of using office MS- word
	CO2	To provide the knowledge of working with MS- EXCEL.
	CO3	To provide the knowledge of working with MS- PowerPoint.
	CO4	To provide the knowledge of working with MS- Access.
	CO5	To provide the knowledge of Animation and Graphics.

**Course outcome(CO) B.COM IInd year**

Corporate Accounting	CO1	To provide the knowledge of Preliminary steps of maintaining the accounts of Capital formation of a company.
	CO2	To provide the knowledge of how the Final Accounts of company are prepared.
	CO3	To provide the knowledge of Valuation of Goodwill and Shares in different methods.
	CO4	To provide the knowledge of Amalgamation and Reconstruction of company.
	CO5	To provide the knowledge of Consolidated Balance Sheet of holding company to any of its Subsidiary company.
Company Law	CO1	To provide the knowledge of Corporate Personalities and different types of companies.
	CO2	To provide the knowledge of Memorandum and Article of Association, Prospectus etc.
	CO3	To provide the knowledge of Capital Management.
	CO4	To provide the knowledge of Company meetings.
	CO5	To provide the knowledge of Power, Rights, Winding up of companies.
Cost Accounting	CO1	To provide the knowledge of Basic concept of Cost Accounting.
	CO2	To provide the knowledge of Accounting of labour and overheads.
	CO3	To provide the knowledge of Unit Costing and Contract Costing.
	CO4	To provide the knowledge of Operating costing.
	CO5	To provide the knowledge of Cost Records.
Principles of Management	CO1	To provide the knowledge about the Concept, Significance and Functional Areas of Management.
	CO2	To provide the knowledge of Planning Process in an Organisation.
	CO3	To provide the knowledge of Organisation Structure of an Organisation.
	CO4	To provide the knowledge of how to motivate and lead people at work area.
	CO5	To provide the knowledge of Managerial Control and Concept of Management of Change.
Business Statistics	CO1	To provide the knowledge of Basic Concept of statistics and Central Tendency.
	CO2	To provide the knowledge of Dispersion and their Measures.
	CO3	To provide the knowledge of Correlation.
	CO4	To provide the knowledge of how to use of Index number in various field.
	CO5	To provide the practical knowledge of Forecasting and its methods and Theory of Probability and its Approaches.
Fundamentals Of Entrepreneurship	CO1	To provide the knowledge of Entrepreneur and their Role for Socio – Economic Environment and Decision Making Skill for Business Planning.
	CO2	To provide the knowledge of How to promote a new venture and what legal requirements are necessary for establishment of new unit.
	CO3	To provide the knowledge of Entrepreneurial Behaviour.
	CO4	To provide the knowledge of FDP Programmes and Role of Government.
	CO5	To provide the knowledge of Role of Entrepreneur in different aspects.
Internet Applications & E-Commerce	CO1	To provide the basic knowledge of HTML
	CO2	To provide the basic knowledge of Designing of Web page.
	CO3	To provide the basic knowledge of HTML document Structure and

		Forms.
	CO4	To provide the basic knowledge of E-commerce and Business Strategy.
	CO5	To provide the basic knowledge of B to e- commerce, B to C E-commerce, E- business etc.
Relational Database Management System	CO1	To provide the basic knowledge of Database System .
	CO2	To provide the basic knowledge of Relational Database Management System model.
	CO3	To provide the basic knowledge of Relational Database Design.
	CO4	To provide the basic knowledge of RDBMS s Software.
	CO5	To provide the basic knowledge about Security.

### Course outcome(CO) B.COM IIIrd year

Income Tax	CO1	To provide the knowledge of Basic concept of Income Tax and practical knowledge of Residential status of Assesses.
	CO5	To provide the practical knowledge of calculation of tax of salary and house property under income head.
	CO5	To provide the practical knowledge of Capital Gain and other sources.
	CO5	To provide the practical knowledge of Tax Management.
Auditing	CO1	To provide the knowledge of necessity of doing Audit, Types and Audit Program.
	CO2	To provide the knowledge of Techniques of Company Audit.
	CO3	To provide the knowledge of Role of Auditor and Audit of different organisation.
	CO4	To provide the knowledge of Non -Profit Companies under special circumstances.
	CO5	To provide the knowledge of Recent Trends in auditing.
Indirect Tax with GST	CO1	To provide the practical and theoretical knowledge of Custom Duty.
	CO2	To provide the knowledge of State excise and C ENVT.
	CO3	To provide the knowledge of introduction and provisions of GST.
	CO4	To provide the knowledge of procedure for registration of GST.
	CO5	To provide the practical knowledge of Assessment and Return of Tax.
Management Accounting	CO1	To provide the basic knowledge of Concept of Management Accounting.
	CO2	To provide the knowledge of Fund Flow and Cash Flow Statement.
	CO3	To provide the knowledge of Absorption and Marginal Costing.
	CO4	To provide the knowledge of Budgeting for Profit Planning and Control.
	CO5	To provide the practical knowledge of Standard Costing and Variance Analysis.
Financial Management	CO1	To provide the knowledge of Basic concept and function of Financial Management and Financial Planning.
	CO2	To provide the practical knowledge of Capital Budgeting.
	CO3	To provide the practical knowledge of calculation of Cost of Capital.
	CO4	To provide the practical knowledge of Capital Structure.
	CO5	To provide the knowledge of techniques of Management of Working Capital and Factors determining Working Capital requirements.

Financial Market Operations	CO1	To provide the knowledge regarding Financial System, Indian Money Market and the modes of Fund Generation in the Indian Money Market as it is key to development.
	CO2	To provide the knowledge of Primary & Secondary Market and transactions of capital market.
	CO3	To provide the knowledge of procedure of Investing & Investors are protected by the Regulatory Authorities.
	CO4	To provide the knowledge of how the SEBI is providing multiple services to investors.
	CO5	To provide the knowledge of various other Financial Services like Merchant Banking , Credit Rating , Mutual Funds etc.
Programming in Visual Basic	CO1	To provide the knowledge of visual basic, Creating a Program in Visual Basic.
	CO2	To provide the knowledge of controlling Program Execution.
	CO3	To provide the knowledge of Procedure, Function Error Trapping and Debugging.
	CO4	To provide the knowledge of Sequential and Random files.
	CO5	To provide the knowledge of Data Access using the ADO data control and Report generation.
System Analysis Design & MIS	CO1	To provide the basic knowledge of System Analysis.
	CO2	To provide the basic knowledge of tools of Structured Analysis and System Implementation.
	CO3	To provide the basic knowledge of System Design & their Implementation.
	CO4	To provide the knowledge of MIS and their Subsystem.
	CO5	To provide the knowledge of Information System Concept.

## **BCA PART-1(Three Years Degree Programme)**

### **Programme Outcome (PO) BCA**

At the end of the three year BCA programme the students will be able to:

- Understand, analyze and develop computer programs in the areas related to algorithm, web design and networking for efficient design of computer based system.
- Work in the IT sector as system engineer, software tester, junior programmer, web developer, system administrator, software developer etc.
- Apply standard software engineering practices and strategies in software project development using open source programming environment to deliver a quality of product for business success.

### **Programme Specific Outcomes (PSO) BCA**

**PSO 1.** Focuses on preparing students for roles pertaining to computer Applications and IT Industry.

**PSO2.** Developing programming skills, networking skills, packages, programming languages and modern techniques of IT.

**PSO3.** Professional skills: Attain the ability to design and develop computer applications, evaluate and recognize potential risks and provide innovative solutions.

**PSO4.** Successful Career and Entrepreneurship: Explore technical knowledge in diverse area of Computer Applications and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies.

**PSO 5.** Evolve as globally competent computer professionals possessing leadership skills for developing innovative solutions in multidisciplinary domain.

**PSO 6.** A few of them being like Software Programmer, System and network Administrator, Web Designer, faculty of Computer Science and Applications.

**PSO7.** Students can develop static and dynamic websites using web technologies such as HTML, CSS , PHP, and JAVA Script and providing connectivity with backend using Databases such as MS Access.

### **Course Outcomes: BCA PART-1:- C Programming**

CO1. Before implementation of any program, student has to learn about the program logic by using program development tools like algorithm, flowcharts and pseudo code. We taught students by taking real life examples about algorithm, flowcharts and pseudo code. Now our students have learnt how to develop the logic of the program.

CO2. Once the algorithm/ flowchart/pseudo code part is over, the student has to implement the program code by understand the defining of variables, data types, control statements like if, while, do-while, for, switch etc. statements. They have to also type & run the program on computer. Now all the students have learnt how to write and execute the program.

CO3. The students have to learn about efficiency of program by understanding derived data types (array, string, function, pointers) and user-defined data types (structure, union). Students were efficiently writing the programs using derived and user-defined data types to save program execution time and memory.

### **Course Outcomes: BCA PART-1:- Computer Fundamentals**

CO1: Bridge the fundamental concepts of computers with the present level of knowledge of the students

CO2: Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming

CO3: Familiarise operating systems, programming languages, peripheral devices, networking, multimedia and internet

CO4: Understand binary, octal and hexadecimal number systems and their arithmetic

CO5:- Students will be able to solve problems based on Proposition, Predicates and Logic. Logic topic will help them a lot in Digital Electronics which they will be learning in further semester.

CO6:- Students will be able to perform various operations based on Sets theory.

CO7:- To understand and solve the problems related to relations and functions.

CO8:- To Comprehend with Group, Lattices and its Properties.

CO9:- Students will be able to solve problems on graph theory .the Graph theory has application in various field of computer science like, Computer Graphics ,Data Structure, Artificial Intelligence etc. All these Topics will help the students to understand various important concepts of other subject of the course in higher studies.

### **Course Outcomes: BCA PART-1:- Web Technology**

CO 1.Students Implemented interactive web page(s) using HTML, CSS and JavaScript.

CO 2.Students were able to Design a responsive web site using HTML5 and CSS3.

CO 3.Students were able to Demonstrate Rich Internet Application. Build Dynamic web site using DHTML , JSP.

CO 4. Students were able to develop server side application using PHP

CO 5. Students were able to build Database, establish connectivity with databases like My SQL using PHP

CO6. Students were able to handle data from user, validate data so that error free application being developed

### **Course Outcomes: BCA PART-1:- Office Automation**

CO 1. Students were able to understand working of windows operating system and got expertise in handling various windows operations & utilities

CO2.students were able to create effective & efficient word documents using various Feature of word.

CO 3. Students were able to create different spreadsheet like mark list, attendance sheet, balance sheet, budget .also they were able to create various charts

CO 4. Students were able to create effective power point presentation with various design and animation effects.

### **Course Outcomes: BCA PART-1:- Discrete Mathematics**

CO1. The students after the completion of this course will be able to describe Graphs, Trees, Spanning Trees, Circuits, finite state machine and their types.

CO2. The students after the completion of this course will be able to describe the difference between Mealy and Moore machine.

CO3. The students after the completion of this course will be able to compute the output of a finite state machine corresponding to their next state of the given input.

### **Course Outcomes: BCA PART-II:-Object Oriented Programming in C++**

CO1. C++ is superset of C language. It provides the data hiding feature. Students learned the difference between C and C++. They also learn the features of OOP like classes, objects, data abstraction & encapsulation, inheritance, polymorphism, message passing & dynamic binding etc.

CO2. Students learned about program writing using concept of OOP by taking the example of real life applications. They also learned how to protect data from outside world using different types of visibility labels and converting C programs into C++ program.

CO3. When the exception is raised, program is abnormally terminated. For handling such exceptions during the execution of program, students have learned exception handling model.

### **Course Outcomes: BCA PART-II:-Data Communication and Network**

CO1: Students were able to understand the fundamental concepts of computer networking.

CO2: Students got familiarized with the basic taxonomy and terminology of the computer networking area.

CO3: Students were able to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

CO4: The students learned about the services provided, protocols used, networking devices used and function of in each and every layer of OSI reference model.

CO5: The students learned about the basics of Integrated Services Digital Network (ISDN), Interfaces of ISDN, Transmission structure, ISDN Protocols and broadband ISDN

### **Course Outcomes: BCA PART-II:-Linux Operating System**

CO1: Students able to identified and used Linux utilities to create and manage simple file\ processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.

CO2: Students effectively used the Linux Operating system to accomplished typical personal, office, technical, and software development tasks.

CO3: Students able to choose appropriate Linux operating system commands to make effective use of the environment and write efficient, effective scripts with documentation to solve problems.

### **Course Outcomes: BCA PART-II:-DBMS**

CO 1:- To analyze data base design methodology.

CO 2:- Acquire Knowledge in Fundamental of data base management system.

CO 3:- Analyze the difference between the traditional file system and DBMS.

CO 4:- Handle with different data base languages.

CO 5:- Draw various data model using ER modeling for real life applications along with that they will be able to construct queries mathematically through relational algebra.

CO 6:- Understand the underlying concept of database technique.

CO 7:- Design and implementation of data base schema for a given problem domain.

CO 8:- Students will be able to handle with different database languages.

CO 9:- Students will be able to deal with Table, View, Procedures, Functions, Triggers.

CO 10:- Introduction to different database packages (Oracle/MYSQL/DB 2 etc).

CO 11:- Students will be able to use data base connectivity as front end.

CO 12. By the end Students will be able create projects.

### **Course Outcomes: BCA PART-II:-Numerical Analysis**

CO1. The students after the completion of this course will be able to solve the ordinary and partial Gauss-Jordan method, Cholesky's Method.

CO2. The students after the completion of this course will be able to solve the Interpolation of Single variable functions.

CO3. The students after the completion of this course will be able to solve the Numerical solution of ordinary differential and Integral equations.

### **Course Outcomes: BCA PART-II:-Differentiation and Integration**

CO1. The students after the completion of this course will be able to solve the ordinary and partial differential equations.

CO2. The students after the completion of this course will be able to determine Jacobian of two and three variables.

CO3. The students after the completion of this course will be able to compute the Successive Differential Equation of the given equation

CO4. The students after the completion of this course will be able to describe and solve differential equations and Integration.

### **Course Outcomes: BCA PART-III:-Software Engineering**

CO1. The students learned the ability to work Significantly in all application domain from System Software to Embedded software to Artificial Intelligence and Robotics.

CO2. They learned how to apply the software engineering lifecycle by Demonstrating the use of requirement analysis from Communication, Planning, Analysis design, Construction and Deployment.

CO3. They learned to demonstrate and ability to use the techniques tools necessities for engineering practice and to work as an individual and as a part of multidisciplinary team to deliver quality software.



CO4. They identified the appropriate design pattern to solve object oriented design problem and construct design solution by using behavioral patterns.

CO5. The students learned to understand the software architecture and build the system from the component.

CO6. The students learned to test the software without the knowledge of internal structure of program or application.

CO7. The students learned about testing as a Process how it can be classified into Verification and Validation testing Process. They also learned and understand the different aspects of testing process the Technical Aspect, Managerial Aspect and Economic aspect of testing Process.

CO8. The students studied the factors which causes the Defects to enter in software . The Impacts the Defect have on Software Artifacts. And the Impact of Defect from users point of view. The students also learned how to calculate the real life Cost of the Defect in the Software Project.

CO9. They learned the different Methods Such as Pareto Analysis and Fishbone Analysis and how it can be used in software and defect prevention techniques such as Review and Inspection , Walkthroughs Defect logging and Documentation.

CO10. The students studied all the levels in testing Unit Testing , Integration testing, System Testing and Acceptance testing. They learned how to Design and Plan each of this test and record there results in Test Logs.

CO11. The students studied the Role of Managers, Developers / Tester and User Client in Software Development .

CO12. The students learned about the system, the steps for building the system, the economic, technical and operational feasibility of the system. They learned and understand the different data collections methods for the system such as interviews, questionnaires and onsite observation.

CO13. The students studied the Data Flow Diagram and the other tools required to design the system.

CO14. The implemented system tested using different testing methods, such as unit testing, integration testing, white box testing, black box testing etc.

CO15. The students learned the ability to work Significantly in all application domain from System Software to Embedded software to Artificial Intelligence and Robotics.

CO16. They learned how to apply the software engineering lifecycle by Demonstrating the use of requirement analysis from Communication, Planning, Analysis design, Construction and Deployment.

CO17. They learned to demonstrate and ability to use the techniques tools necessities for engineering practice and to work as an individual and as a part of multidisciplinary team to deliver quality software.

CO18. They identified the appropriate design pattern to solve object oriented design problem and construct design solution by using behavioral patterns.

CO19. The students learned to Understand the software architecture and build the system from the component.

CO20. The students learned to test the software without the knowledge of internal structure of program or application.

### **Course Outcomes: BCA PART-III:-OPERATING SYSTEM**

CO1. Describe the basic components of an operating system and their role in implementations for general purpose, real-time and embedded applications.

CO2. Define the concepts of processes, threads, asynchronous signals and competitive system resource allocation.

CO3. Explain what multi-tasking is and outline standard scheduling algorithms for Multi-tasking.

CO4. Discuss mutual exclusion principles and their use in concurrent programming including semaphore construction and resource allocation.

CO5. Expose the details of major operating system concepts, overview of system memory management and the implementation of file systems.

CO 6. Fundamental understanding the role, function and services of operating system.

CO 7.Students would have acquired the knowledge related to CPU scheduling algorithms.

CO 8. Students would be able to categorized the difference between different process, thread and multi-Threading.

CO 9. Students will gain the knowledge about the concepts of deadlock in operating system and how they Can be managed /avoided and implement them in multithreading system.

CO 10. They will have the knowledge about the different types of I/O management, disk scheduling, and protection and security problems faced by operating systems and how to minimize these problems if occurred.

### **Course Outcomes: BCA PART-III:-Java Programming**

CO1. Students were able to understand concept of Object Oriented Programming & Java Programming Constructs.

CO2.Students were able to understand basic concepts of Java such as operators, classes, objects, inheritance, packages, Enumeration and various keywords.

CO3. Students were able to understand the concept of exception handling and Input/ Output operations.

CO4. Students were able to design the applications of Java , Java applet and analyze ,design the concept of Event Handling and Abstract Window Toolkit.

CO5. Students were able to write a project that may be selected from among the following: applets for inclusion in web pages; applets to access enterprise data bases in robust, enterprise three level applications; secure communications over the internet.

### **Course Outcomes: BCA PART-III:-Multimedia**

CO1. Understand the characteristics of different media; understand the representations of different multimedia data; understand different data formats; be able to take into considerations in multimedia system designs;

CO2.Understand different compression principles; understand different compression techniques; understand different multimedia compression standards; be able to design and develop multimedia systems according to the requirements of multimedia applications.

CO3.Program multimedia data and be able to design and implement media applications;

### **Course Outcomes: BCA PART-III:-COMPUTER SYSTEM ARCHITECTURE**

CO 1. Understand the theory and architecture of central processing unit.

CO 2. Analyze some of the design issues in terms of speed, technology, cost, performance.

CO 3. Design a simple CPU with applying the theory concepts.

CO 4. Use appropriate tools to design verify and test the CPU architecture.

CO 5. Learn the concepts of parallel processing, pipelining and interprocessor communication.

CO 6. Understand the architecture and functionality of central processing unit.

CO 7. Exemplify in a better way the I/O and memory organization.

CO 8. Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.

### **Course Outcomes: BCA PART-III:-Differentiation and Integration**

CO1. The students after the completion of this course will be able to solve the ordinary and partial differential equations.

CO2. The students after the completion of this course will be able to determine Jacobian of two and three variables.

### **Course Outcomes: BCA PART-III:-Calculus & Geometry**

CO1. The students after the completion of this course will be able to describe Cone, Sphere, Cylinder, Generating Lines, Straight line, Plane etc.

CO2. The students after the completion of this course will be able to find the limit of a function of one and two and test its continuity and differentiability.

**Department of Zoology**  
**Bhilai Mahila Mahavidyalaya, Bhilai Nagar, Bhilai**  
**Criteria II (Under Graduate Course BSc Zoology)**

**Program outcomes (PO) for BSc. Zoology Paper**

In the campus of Bhilai Mahila Mahavidyalaya for Bachelor of Science. Zoology is one of the combination subjects for Biology students. BSc with Zoology started with the annual system examination pattern two theory papers (Paper I and Paper II) and One Lab Course has been incorporated with each Year (BSc I Year, BSc II year and BSc III Year).

After successful completion of three year degree program in Chemistry students should be able to:

PO1 Demonstrate and apply the fundamental knowledge of the basic principles of major fields of classic and modern Zoology.

PO2 Apply knowledge to solve the issues (ethics) related to animal and human sciences.

PO3 Take appropriate steps towards conservation of endemic and endangered animal species Skill

PO4 To create awareness amongst students for the basic and applied areas of Zoology

PO5 To orient students about the importance of abiotic and biotic factors of environment and their conservation.

PO6 To provide an insight to the aspects of animal diversity, Hotspots etc.

PO7 To inculcate good laboratory practices in students and to train them about proper handling of lab instruments. Lab precaution method has also been provided to the students for their further research practice.

**Program Specific Outcomes (PSO) for BSc. Zoology Paper**

Following are the some program specific outcome for BSc. Zoology

PSO1 Understand the nature and basic concepts of, Invertebrate and vertebrate biology, cell biology, genetics, taxonomy, physiology, ecology, Ecology, Environmental-biology, Toxicology ,Microbiology and Medical Zoology, GENETIC'S, CELL PHYSIOLOGY, BIOCHEMISTRY, BIOTECHNOLOGY AND BIOTECHNIQUES) and applied Zoology.

PSO2 Analyze the relationships among animals with their ecosystems.

PSO3 Perform procedures as per laboratory standards in the areas of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Clinical science, tools and techniques of Zoology, Toxicology, Sericulture, Biochemistry, Fish biology, Animal biotechnology, Immunology and research methodology.

PSO4 Understand the applications of Zoology in Agriculture, Apiculture, Fisheries, Economic Zoology, Medicine, Pharmaceutical and daily life

PSO5 Contributes the knowledge for Nation building, human Rights, human act etc.

## **Course Outcomes (CO) for BSc. Zoology Paper**

### **BSc. I Year**

#### **PAPER - I (CELL BIOLOGY & INVERTEBRATES)**

CO1 The Students will understand the importance of cell as a structural and functional unit of life and compares between the prokaryotic and eukaryotic system and extrapolates the life to the aspect of development

CO2. The dynamism of bio membranes indicates the dynamism of life. Its working mechanism and precision are responsible for our performance in life and The cellular mechanisms and its functioning depend on cell organelles and their structures

CO3. The student will be able to understand, classify and identify the diversity of animal kingdom.

CO4. The student will understand the importance of classification of animals and classify them effectively (Phylum wise) using the six levels of classification

CO5 The student knows his role in nature as a protector, preserver and promoter of life which he has achieved by learning, observing and understanding life.

#### **PAPER - II (VERTEBRATES & EMBRYOLOGY)**

CO1 The Students will understand the concept of origin and classification of Chordates.

CO2 The Students will gain knowledge about mammalian class and comparative account of Fishes, Amphibia and Reptilia.

CO3 Students will identify the developmental stages and describe the key events in early and systematic embryological development

CO4. Explain the theories of preformation, and concepts like growth, differentiation and reproduction.

CO5 Explain the principles and process of fertilization and cleavage and Elucidation of early embryonic development of invertebrates and vertebrates

### **BSc. II Year**

#### **PAPER - I (ANATOMY AND PHYSIOLOGY)**

CO1 Define the basic terms and concept of human physiology and their mechanism.

CO2 Explain the physiological processes in mammals.

CO3 Explain the anatomy of various systems.

CO4 Illustrate the reproductive cycles with hormonal control.

CO5 Diagrammatically represents the working of kidney. Justify the endocrine gland and disorders.

## **Paper-II (VERTEBRATE ENDOCRINOLOGY, REPRODUCTIVE BIOLOGY BEHAVIOUR, EVOLUTION AND APPLIED ZOOLOGY)**

CO1 Define the basic concept of Endocrine and Exocrine gland and their secreted hormone

CO2 Define the biosynthesis of hormone

CO3 Define the Reproductive cycle in vertebrates, Menstruation, lactation and pregnancy, parturition

CO4 Explain Theories of organic evolution, Variation, Mutation, Isolation and Natural selection and Evolution of Horse

CO5 Study about the human behavior and Introduction to Ethology: Branches and concept of ethology and gain Knowledge about the Economic Zoology and their importance.

## **BSc. III Year**

### **Paper-I (ECOLOGY, ENVIRONMENTAL BIOLOGY: TOXICOLOGY, MICROBIOLOGY AND MEDICAL ZOOLOGY)**

CO1 Describe Aims and scopes of Ecology

CO2 Explain about the biodiversity, Food chain in a freshwater ecosystem, Conservation of Natural resources

CO3 Knowledge gain about the Principle of systematic toxicology

CO4 Application of General and Applied microbiology, milk and milk products. Industrial microbiology

CO5 Brief introduction to pathogenic micro-organisms, Rickettsia, Spirochaetes and Bacteria.

### **Paper-II (GENETIC'S, CELL PHYSIOLOGY, BIOCHEMISTRY, BIOTECHNOLOGY AND BIOTECHNIQUES)**

CO1 Describe about basic concept of Genetics, cell Physiology.

CO2 Describe Biosynthesis of biomolecules

CO3 Describe Applications of biotechnology in (i) Pharmaceutical industry, and (ii) Food processing industry.

CO4 Explanation about Application of Biotechnology in the field of medicine, toxicology research , Recombinant DNA & Gene cloning, Cloned genes & other tools of biotechnology (Tissue culture, Hybridoma, Transgenic Animals and Gene library)

CO5 Theory and lab knowledge about the minor instruments such as pH meter, Colorimeter, Microscopy- Light microscopes: Compound, Phase contrast & Electron microscopes , Centrifuge Separation of biomolecules by chromatography & electrophoresis

## **Practical knowledge about BSc. (I, II and III Year)**

1. First-hand knowledge about identification of non-chordate and chordate specimens (fresh and preserved) along with larval forms and study of endoskeleton of vertebrates.
2. Students are able to handle microscopes, work with camera lucida and micrometers.
3. Identification of zooplanktons and phytoplanktons.
4. Gain skill about histological slide preparation, staining and mounting.
5. Students gain skill about determination of pH and quantitative analysis of blood cells.
6. Students are able to parasites from rectal and fecal contents of animals.
7. Students are able to collect parasite and pest specimen
8. Students Performed Minor and Major Dissection by using alternative clay modeling in college laboratory.
9. Hands on practice on Cytological preparation- Onion root-tip "Squash Preparation" for mitosis/Grasshopper testis squash for meiosis
10. Students analyze the limb girdles and vertebrae of Frog, Varanus, Fowl and Rabbit.
11. Identification of species and individual of honey bee.
12. Observation study performed in Life cycle of honey bee and silkworm.
13. Exercise based on Evolution and Animal behavior
14. Performed Estimation of population density, Percentage frequency, and Relative density.
15. Field experiment performed by the students and Analysis of Producers and consumers in grassland.
16. Lab Experiment performed and detection of gram-negative and gram-positive bacteria.
17. Pathalogy experiament such as Blood group detection (A,B, AB & O), R.B.C., W.B.C. count., Blood coagulation time will performed by the students.
18. Lab Experiment of Biochemistry test: Biochemical detection of Carbohydrate, Protein and Lipid.

## **PAPER-II (Paper Code-0918) (GENETIC'S, CELL PHYSIOLOGY, BIOCHEMISTRY, BIOTECHNOLOGY AND BIOTECHNIQUES)**

1. Describe about basic concept of Genetics, cell Physiology.
2. Describe Biosynthesis of biomolecules
3. Describe Applications of biotechnology in (i) Pharmaceutical industry, and (ii) Food processing industry.

## **Practical BSc. (I, II and III Year)**

19. First-hand knowledge about identification of non-chordate and chordate specimens (fresh and preserved) along with larval forms and study of endoskeleton of vertebrates.
20. Students are able to handle microscopes, work with camera lucida and micrometers.
21. Identification of zooplanktons and phytoplanktons.
22. Gain skill about histological slide preparation, staining and mounting.
23. Students gain skill about determination of pH and quantitative analysis of blood cells.
24. Students are able to parasites from rectal and fecal contents of animals.
25. Students are able to collect parasite and pest specimen
26. Students Performed Minor and Major Dissection by using alternative clay modeling in college laboratory.
27. Hands on practice on Cytological preparation- Onion root-tip "Squash Preparation" for mitosis/Grasshopper testis squash for meiosis
28. Students analyze the limb girdles and vertebrae of Frog, Varanus, Fowl and Rabbit.
29. Identification of species and individual of honey bee.
30. Observation study performed in Life cycle of honey bee and silkworm.
31. Exercise based on Evolution and Animal behavior
32. Performed Estimation of population density, Percentage frequency, and Relative density.
33. Field experiment performed by the students and Analysis of Producers and consumers in grassland.
34. Lab Experiment performed and detection of gram-negative and gram-positive bacteria.
35. Pathology experiment such as Blood group detection (A,B, AB & O), R.B.C., W.B.C. count., Blood coagulation time will performed by the students.
36. Lab Experiment of Biochemistry test: Biochemical detection of Carbohydrate, Protein and Lipid.

## **OUTCOMES OF BIOTECHNOLOGY**

### **Programme outcome (POs):**

The B.Sc and M.Sc. Program of Biotechnology at Bhilai Mahila Mahavidyalaya, Bhilai, started in 2004 and 2006, aims to train students in Biotechnology where in engineering and technology principles could be used to probe biological questions or to develop technologies, devices and systems that require substantive expertise in Biology, Agriculture, Pharmaceutical, Industrial, as well as Clinical Research components. The students in this program acquire knowledge, critical thinking skills and experience in conducting cutting edge research.



## **Programme Specific Outcomes (PSOs):**

**PSO1:** Postgraduate students will be able to demonstrate and apply their knowledge of cell biology, biochemistry, microbiology and molecular biology to solve the problems related to the field of biotechnology.

**PSO2:** Postgraduate students will be able to demonstrate and apply the principles of bioprocess engineering in the design, analysis, optimization and simulation of bioprocess operations.

**PSO3:** Students will be able to gain fundamental knowledge in animal and plant biotechnology and their applications.

**PSO4:** Students will be equipped to understand three fundamental aspects in biological phenomenon: a) what to seek; b) how to seek; c) why to seek?

**PSO5:** Student will be able to (a) Describe fundamental molecular principles of genetics; (b) Understand relationship between phenotype and genotype in human genetic traits; (c) Describe the basics of genetic mapping; (d) Understand how gene expression is regulated.

**PSO6:** Students will be able to (a) To elaborate concepts of biochemistry with easy to run experiments; (b) To familiarize with basic laboratory instruments and understand the principle of measurements using those instruments with experiments in biochemistry.

**PSO7:** Students will be able to understand various facets of molecular procedures and basics of genomics, proteomics and metabolomics that could be employed in early diagnosis and prognosis of human diseases.

**PSO8:** Students will be able to gain hands on experience in gene cloning, protein expression and purification. This experience would enable them to begin a career in industry that engages in genetic engineering as well as in research laboratories conducting fundamental research

**Course Outcomes:** On the successful completion of the subject, the student get an overall understanding of structure of atoms, molecules and chemical bonds, Gains knowledge on enzyme kinetics. Understands biopolymers and metabolic reaction in the living systems. To understand Cellular structure, biostatics analysis, bioprocessing engineering, Genetics analysis and usage of instruments in experiments for future research.

### **COS1: Cell Biology**

- Understand the importance, evolution and diversity of cells.
- Learns to visualize the cells by employing different types of microscopes.
- Able to describe the organization, structure and functions of cell organelles.
- Understand the biochemical pathways associated with the cellular organelles.
- Rationalize different transport mechanisms occurring in the cell.
- Understand the cell signaling mechanisms.
- Perceive over all mechanism of cell growth and cell cycle and division.
- Understand the sequential events that occur during mitosis and meiosis.
- Introduce the concepts of stem cell and cell culturing techniques.

- Sensitized on cancer types, oncogenes and tumor suppressor genes.

## **COS2: Genetics**

- Learn the basics of classical, molecular and evolutionary genetics.
- Understands the process of Genetic Recombination – and the elements of recombination in *E. coli*, RecA, RecBCD.
- Knowledge on DNA Structure and its variations, properties and modification of DNA.
- Learning the genetic changes due to mutations- Point Mutations, Deletions, Insertions, and Damage, DNA repair and recombination.
- Overview of DNA packaging; Synthesis and processing of RNA and proteins; Regulation of gene expression.
- Knowledge on the repetitive DNA sequences and transposable elements; Promoters and methods of isolation; Transcription factors- their classification and role in gene expression.
- Understands genetic systems - Growing cells for genetics experiments - Genetic Selections - Mapping with Generalized Transducing Phage.
- Learning the principles of Bacterial Sex.
- Knowledge on the elements of Yeast and *Drosophila* Genetics.
- Learning the tools for plant molecular genetics - Epigenetic control of gene expression.
- Details of the regulatory RNA and their role in gene regulation - Small RNAs, RNA interference and its applications.

## **COS3: Microbial Physiology**

- The student will be able to understand microbial diversity; physiology and nutrition.
- The student will be able to identify microbes using modern techniques.

## **COS4: Biomolecules**

- To understand the concept of biochemical regulations.
- Describe the structure and function of DNA and RNA in the cell
- To differentiate the structure of nucleic acid, types of Nucleic acid and its Forms.
- To differentiate between eukaryotic and prokaryotic chromosomal structure.
- Describe the structure of proteins, including the significance of amino acid R-groups and their impact on the three-dimensional structure of proteins.
- Students will have knowledge on biomolecules, their importance and Classification, forces stabilizing their structures, write and relate the role of them with day to day life.

## **COS5: Biostatistics & computer**

- Students can apply basic concept of biostatistics for various research purpose.
- Understand simple calculations.
- How to plan and execute research designs.
- Analyse data, interpret, and present information.
- Publishing research data Calculate; analyse and compare observed data; perform simple sums in proportions and algebraic function.

## **COS6: Molecular Biology Genetic Engineering and Immunology**

- To explain genome organization in higher organisms.
- To describe kinetic classes of DNA and Gene families.
- To understand the steps involved in recombinant DNA technology.
- To explain the construction of DNA & c DNA library and their applications.
- To get insight in Primary and Secondary organs of Immune system.
- To describe antibody-antigen interaction, autoimmune diseases.

## **COS7: Plant Tissue Culture**

- Learning important milestones in the plant tissue culture.
- Understanding the concepts and principles of Plant tissue culture.
- Learning the techniques of sterilization and monitoring method of sterilization.
- Learning different pathways of plant regeneration under in vitro conditions - organogenesis and somatic embryogenesis.
- Techniques of establishing cell suspension culture. Synthetic seeds and applications.
- Understanding the techniques of virus elimination – methods of virus indexing. Meristem and Shoot tip culture and Applications.
- Performing procedures for Micro propagation techniques.
- Culturing of reproductive structures - anther, microspores, embryos, endosperm, Ovule and ovary cultures and methods to produce haploids.
- Protoplast isolation, culture and protoplast fusion - applications -. Somaclonal variation - applications.
- Learning methods to conserve germplasm under In vitro. Production of Secondary metabolites production through cell culture.

## **COS8: Bioprocess Engineering**

- Plan a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up. Apply modeling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.
- Aware of various methodologies for biomass production.
- Product isolation using various analytical methods.

## **COS9: Animal Tissue Culture**

- Understand principles of plant and animal culture, media preparation and can explain invitro fertilization and embryo transfer technology, meristem culture and clonal propagation of plant.
- Know how transgenic animals, cryopreservation, apoptosis, animal cloning, cell transformation, DNA microinjection, production of vaccines is done.
- Students will have an insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins and can describe commercial production of fuels, microbial enzymes and can apply them in research work.

### **COS10: Genomics and Proteomics**

- Exposed to various strategies and methods of genome sequencing.
- Students will be able to browse whole genome databases.
- Will be able to conduct gene expression profiling.
- Learn various bioinformatics tools of genomic data analysis.
- Learn on assigning gene function through mutagenesis and genetic engineering.
- Will learn how the genome research can be applied in crop improvement research.

### **COS11: Biosafety and Bioethics**

- Detailed description on global status of genetically engineered crops, Asimolar conference on rDNA technology.
- Brief description on the concerns of GE crops – animal and human health, environment, agriculture, horizontal gene transfer and general concerns.
- Principles of safety assessment of transgenic plants and sequential steps in risk assessment.
- Concepts of familiarity and substantial equivalence.
- Environmental risk assessment and food and feed safety assessment.
- International biosafety regulations, Cartagena protocol, OECD consensus documents and Codex Alimentarius.
- Indian biosafety regulations, Biosafety research trials and GM labeling.
- Brief description on bioethics, ethical issues on GM crops, Nuffield council on bioethics.

### **COS12: Skill Development**

- Capacity building and skill development of the students in planning, development, formulation, monitoring and evaluation of project for entrepreneurial proficiency.
- Learn specific techniques on Plant Biotechnology/Bioinformatics and get hands-on training on the research theme of the host industry/institution.
- Develop communication skills through inter-personal interactions with lab members at the host institute and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

### **COS13: Project formulation, Execution and Presentation**

- Students learn to analyse the researchable problems and devised strategies to overcome in project mode.
- Formulate project proposal with key indicators for monitoring the progress.
- Learn to execute the project and perform mid-term corrections as alternative strategies.
- Helps students learn general conduct and discipline of working in team environment in lab.
- Inculcates creativity in the execution of the project and presentation.

### **COS14: Educational Tour**

- Exposure to leading national and international institutions and their working environment and the state-of-the-art facilities.
- Learn on the different agro-climatic zones across India and the cropping pattern in various parts of India.
- Develop communication skills by interactions with their faculty and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

### **Entrepreneurial Development in Biotechnology**

- Entrepreneurial Development in Biotechnology for a period of 10 weeks On-campus/Off-campus in one of the following skill development courses based on students interest.
- Micropropagation of Commercially Important Crops.
- Secondary Metabolite Production from Plant Cell Cultures.
- Molecular Diversity Analysis of Plants and their Associated Organisms.
- Marker-assisted Introgression of Target Genes.
- Bioprospecting for Novel Biomolecules / Genes.
- Isolation and Characterization of Agronomically Important Genes.
- Genetic Transformation and Evaluation of Transgenic Plants for Stress Resistance.
- Recombinant Protein Production in Microbial Systems
- Students learn tools and techniques in various modules of biotechnology.
- Perform procedures for the De novo and reference based assembly, Genome finishing and annotation.
- Develop ability to plan and perform experiments.
- Inculcates the team learning environment when students are posed with challenging tasks.
- Ability to formulate winning project proposals for establishing independent firms.
- Knowledge on resource mobilization, cost analysis and economics of the project.

### **Biotechnology Learning Outcomes**

- ✓ **Cognitive Knowledge:** To provide education that leads to comprehensive understanding of the principles and practices of biotechnology.
- ✓ **Information and Computer Literacy:** To educate and make them up to date with the current scientific literature, computer programs and web information.
- ✓ **Experimental Skills:** To provide broad based training in technical skills in methods of biotechnology.
- ✓ **Critical Thinking:** To empower students with the ability to think and solve problems in the field of biotechnology.
- ✓ **Scientific Communication:** To ensure students are able to effectively communicate with biotech and other interdisciplinary professionals.
- ✓ **Professional Attitude:** To produce responsible biotechnologists that can work within the interdisciplinary framework of biotechnology and related fields.

# **OUTCOMES OF MICROBIOLOGY**

## **Programme Outcome (PSOs)**

The B.Sc. and M. Sc. Program in Microbiology at Bhilai Mahila Mahavidyalaya started in 2004 and 2006 aims to train students in Microbiology where in medical, handling in microbial sample could be used to probe biological questions and required substantive expertise in Biology, Agricultural, and Fermentation Technology as well as Clinical Research component. The students in this program acquire knowledge in critical thinking skill and experience in conducting cutting edge research.

## **Programme Specific Outcomes (PSOs)**

**PSO1:** Understand the contributions of various scientists in microbiology and scope of various branches.

**PSO2:** Understand various kinds of prokaryotic & eukaryotic microbes and their interaction.

**PSO3:** Explain and describe importance of organic compounds and its chemistry found in living cells.

**PSO4:** Understand and explain various processes of metabolism of carbohydrates amino acids and vitamins.

**PSO5:** Explain DNA, RNA and protein structure and their synthesis.

**PSO6:** Understand the concept of disease development, spread, control and eradication from society.

**PSO7:** Understand the basic concepts of gene and their regulation of action

**PSO8:** Explain and write various industrial fermentations and bioinstrumentation.

**Course Outcome (COS):** On the successfully completion of the subjects the students get an overall understanding of cellular organization, life cycle and organization of Prokaryotic and Eukaryotic cells, Structure of Protein and Carbohydrates. As well as practical handling in different fields like running Electrophoresis, Estimation by Spectrophotometer, DNA and RNA isolation, Calculation of BOD and COD of water samples, Counting of coli form Bacteria.

## **COS 1: General Microbiology & Microbial Physiology**

- Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures.
- Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also understand the structural similarities and differences among various physiological groups of bacteria/Achaea.
- Know various Culture media and their applications and also understand various physical and chemical means of sterilization.
- Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae.
- Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively.

- Comprehend the various methods for identification of unknown microorganisms.
- Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy.
- Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

## **COS 2: Cell Biology**

- Understand the importance, evolution and diversity of cells.
- Learns to visualize the cells by employing different types of microscopes.
- Able to describe the organization, structure and functions of cell organelles.
- Understand the biochemical pathways associated with the cellular organelles.
- Rationalize different transport mechanisms occurring in the cell.
- Understand the cell signaling mechanisms.
- Perceive over all mechanism of cell growth and cell cycle and division.
- Understand the sequential events that occur during mitosis and meiosis.
- Introduce the concepts of stem cell and cell culturing techniques.
- Sensitized on cancer types, oncogenes and tumor suppressor genes.

## **COS 3: Bioenergetics and Metabolism**

- Describe the concepts of electrolytes and electrolytic dissociation, pH and its biological significance, buffers, Henderson-Hasselbalch equation, biological buffer systems and their importance.
- Understanding the laws of thermodynamics, concepts of entropy, enthalpy and free energy changes and their application to biological systems and various biochemical studies and reactions.
- Conceptual knowledge of aerobic and anaerobic respiration and various intermediary mechanisms involved, oxidative phosphorylation.
- Overview of major biomolecules –carbohydrates, lipids, proteins, aminoacids, nucleic acids, classification, structure, function of the above mentioned biomolecules.
- Discuss the biosynthesis and the degradation pathways involved.
- Specify the biological significance of biomolecules in metabolism.
- Conceptual knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation, enzyme engineering, Application of enzymes in large scale industrial processes.

## **COS 4: Molecular Biology and Microbial Genetics**

- Know the terms and terminologies related to molecular biology and microbial.
- Understand the properties, structure and function of genes in living organisms at the molecular level.
- Explain the significance of central dogma of gene action.

- Have a conceptual knowledge about DNA as a genetic material, enzymology, and replication strategies.
- Understand the molecular mechanisms involved in transcription and translation.
- Describe the importance of genetic code and wobble hypothesis.
- Discuss the molecular mechanisms underlying mutations, detection of mutations and DNA damage and repair mechanisms.
- Explain the concept of recombination, linkage mapping and elucidate the gene transfer mechanisms in prokaryotes and eukaryotes.
- Handle and independently work on lab protocols involving molecular techniques.

### **COS 5: Environmental & Agriculture Microbiology**

- Appreciate the diversity of microorganism and microbial communities inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
- Learn the occurrence, abundance and distribution of microorganism in the environment and their role in the environment and also learn different methods for their detection and characterization.
- Competently explain various aspects of environmental microbiology and microbial ecology and to become familiar with current research in environmental microbiology.
- Understand various biogeochemical cycles – Carbon, Nitrogen, Phosphorus cycles etc. and microbes involved.
- Understand various plant microbes interactions especially rhizosphere, phyllosphere and mycorrhizae and their applications especially the biofertilizers and their production techniques.
- Understand the basic principles of environment microbiology and be able to apply these principles to understanding and solving environmental problems – waste water treatment and bioremediation.
- Know the Microorganisms responsible for water pollution especially Water-borne pathogenic microorganisms and their transmission.
- Comprehend the various methods to determine the Sanitary quality of water and sewage treatment methods employed in waste water treatment.

### **COS 6: Immunology**

- Demonstrate an understanding of key concepts in immunology.
- Understand the overall organization of the immune system.
- Conceptualize how the collection of individual clones of lymphocytes (termed the “immune repertoire”) arises from rearrangement within two genetic loci: the Ig gene in B cells and the antigen receptor in T cells.
- Learn how “clonal selection” allows for the expansion of a limited number of antigen-recognizing lymphocytes in response to an specific antigenic stimulus.
- Begin to appreciate the significance of maintaining a state of immune tolerance sufficient to prevent the emergence of autoimmunity.



- To understand about Tumor Immunology and help the students to understand its immune prophylaxis and immune therapy.
- To make them understand the salient features of antigen antibody reaction & its uses in diagnostics and various other studies.
- Learn about immunization and their preparation and its importance.
- Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read graphs, and understand and use information from scientific papers.
- Demonstrate skill in communication of scientific data in standard format.

### **COS7: Food Microbiology**

- Understand the beneficial role of microorganisms in fermented foods and in food processing and the microbiology of different types of fermented food products – dairy, pickles, Legume and cereal based food products.
- Understand the significance and activities of microorganisms in food and role of intrinsic and extrinsic factors on growth and survival of microorganisms in foods.
- Know the spoilage mechanisms in foods and thus identify methods to control deterioration and spoilage.
- Recognize and describe the characteristics of important pathogens and spoilage microorganisms in foods.
- Learn various methods for their isolation, detection and identification of microorganisms in food and employ in industries.
- Identify ways to control microorganisms in foods and thus know the principles involving various methods of food preservation.
- Understand of the basis of food safety regulations and discuss the rationale for the use of standard methods and procedures for the microbiological analysis of food.
- Acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.

### **COS 8: Medical Microbiology**

- This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.
- It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal Microflora.
- The course provides the conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause disease in the human body.
- It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.
- To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.
- Helps to understand the use of lab animals in medical field.

- Recall the relationship of this infection to symptoms, relapse and the accompanying pathology. Explain the methods of microorganisms control, e.g. chemotherapy & vaccines. Solve problems in the context of this understanding.

### **COS 9: Advances in Biotechnology**

- To know the basics and concepts of various biotechnological related terms.
- Explain the physiological processes that occur during plant growth and development describe the methodology involved in plant tissue culture and plant transgenic.
- Discuss issues related to plant nutrition, quality improvement, environmental adaptation, transgenic crops and their use in agriculture.
- Elucidate the significance of transgenic plants as bioreactors for the production of enzymes, plant bodies, edible vaccines and therapeutic proteins.
- Address bioethical and biosafety issues related to plant transgenic.
- Understand, conduct and gain a thorough knowledge to perform plant tissue culture experiments.
- Explain the basics of animal biotechnology.
- Elucidate the molecular techniques involved in gene manipulation and rDNA technology
- Explain the gene transfer methods for the production of transgenic animals.
- Address bioethical and biosafety issues related to animal transgenic.
- Gain experimental knowledge to perform animal biotechnology related experiments.
- Elucidate the concept of Nano size, nanoparticle its structure and properties of nanoparticles.
- Connect the concepts of physics, chemistry and engineering principles in the study the nano scale nature of the particles.
- Explain the process protocol for the, synthesis and characterization of nanoparticles.
- Discuss the applications of nanoparticles in allied fields.
- Acquire knowledge and lab skills to perform nanotechnology experiments in lab.
- Explain the application of biotechnology in medical and its allied fields, gene therapy , genetic counseling.
- Acquire knowledge about antisense technology, Pharmacogenetics, Toxic genomics, Tissue engineering, Bimolecular engineering and the impact of these novel strategies on human population.
- Address the bioethical issues & concerned linked to medical biotechnology.

### **COS10: Biostatics & computer**

- Students can apply basic concept of biostatistics for various research purpose.
- Understand simple calculations.
- How to plan and execute research designs.
- Analyze data, interpret, and present information.
- Publishing research data Calculate; analyze and compare observed data; perform simple sums in proportions and algebraic function.

### **COS 11: Fermentation Technology**

- Get equipped with a theoretical and practical understanding of Fermentation Technology.
- Appreciate how microbiology is applied in manufacture of industrial products.
- Know how to source for microorganisms of industrial importance from the environment.
- Know about design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer.
- Understand the rationale in medium formulation & design for microbial fermentation, sterilization of medium and air.
- Appreciate the different types of fermentation processes.
- Understand the biochemistry of various fermentations.
- Identify techniques applicable for Improvement of microorganisms based on known biochemical pathways and regulatory mechanisms.
- Comprehend the techniques and the underlying principles in downstream processing.

### **COS 12: Skill Development**

- Capacity building and skill development of the students in planning, development, formulation, monitoring and evaluation of project for entrepreneurial proficiency.
- Learn specific techniques on Plant Biotechnology/Bioinformatics and get hands-on training on the research theme of the host industry/institution.
- Develop communication skills through inter-personal interactions with lab members at the host institute and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

### **COS 13: Project formulation, Execution and Presentation**

- Students learn to analyse the researchable problems and devised strategies to overcome in project mode.
- Formulate project proposal with key indicators for monitoring the progress.
- Learn to execute the project and perform mid-term corrections as alternative strategies.
- Helps students learn general conduct and discipline of working in team environment in lab.
- Inculcates creativity in the execution of the project and presentation.

### **COS 14: Educational Tour**

- Exposure to leading national and international institutions and their working environment and the state-of-the-art facilities.
- Learn on the different agro-climatic zones across India and the cropping pattern in various parts of India.
- Develop communication skills by interactions with their faculty and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

## Entrepreneurial Development in Microbiology

- Entrepreneurial Development in Microbiology for a period of 10 weeks On-campus/Off-campus in one of the following skill development courses based on students interest.
- Microbiology has expanded to include many diverse focuses as people begin to appreciate and accept the importance of microbes in our everyday lives.
- The emergence of new technologies and services in the field of synthetic biology has created opportunities for microbiologists to do so much more, quicker and at a lower cost.
- Many students of microbiology are making their startup in the area of bio fertilizers and bio nutrient manufacturing unit.
- Commercialization of microbial product had open many opportunities in the field of Microbiology.
- Exploiting microbes can be highly lucrative in terms of entrepreneurship in the field of microbiology.
- Students learns tools and techniques in various modules of Microbiology.
- Perform procedures for the De novo and reference based assembly, Genome finishing and annotation.
- Develop ability to plan and perform experiments.
- Inculcates the team learning environment when students are posed with challenging tasks.
- Ability to formulate winning project proposals for establishing independent firms.
- Knowledge on resource mobilization, cost analysis and economics of the project.

### ➤ Microbiology Learning Outcomes

- ✓ **Nature of Science and Scientific Inquiry:** Microbiology majors should be able to discuss science and scientific methodology as a way of knowing. Microbiology majors should make observations, develop hypotheses, and design and execute experiments using appropriate methods. They should be able to explain how the nature of science is applied to everyday problems.
- ✓ **Laboratory Skills:** Microbiology students should master the following laboratory skills: aseptic and pure culture techniques, preparation of and viewing samples for microscopy, use appropriate methods to identify microorganisms, estimate the number of microorganisms in a sample, and use common lab equipment. They should practice safe microbiology, using appropriate protective and emergency procedures.
- ✓ **Data analysis skills:** Microbiology majors should be able to systematically collect, record, and analyze data, identify sources of error, interpret the results, and reach logical conclusions. They should be able to appropriately format data into tables, graphs, and charts for presentation and publication.
- ✓ **Critical Thinking Skills:** Microbiology majors should be able to (1) differentiate between fact and opinion, (2) recognize and evaluate author bias and rhetoric, (3) develop inferential skills, (4) recognize logical fallacies and faulty reasoning, and (5) make decisions and judgments by drawing logical conclusions using sound quantitative and statistically-based reasoning.
- ✓ **Problem-Solving Skills:** Microbiology majors should be competent problem-solvers. They should be able to assess the elements of a problem and develop and test a solution based on logic and the best possible information. Microbiology students should be able to analyze and interpret results form a variety of microbiological methods, and apply these methods to analogous situations. They should use mathematical and graphing skills and reasoning to solve problems in microbiology.
- ✓ **Communication Skills:** Microbiology majors will demonstrate competence in written and oral communication.

- ✓ **Cooperation/Social Responsibility:** Microbiology majors should understand and appreciate the value of cooperating and working effectively with peers and be able to demonstrate a commitment to the process of developing such skills.
- ✓ **Values:** Microbiology majors should identify and discuss the ethical issues and responsibilities of doing science

## **OUTCOMES OF INDUSTRIAL MICROBIOLOGY**

### **Programme outcome (POs):**

The B.Sc. Program of Industrial Microbiology at Bhilai Mahila Mahavidyalaya, Bhilai, started in 2001, aims to train students Industrial Microbiology in where in engineering and technology principles could be used to probe biological questions or to develop technologies, devices and systems that require substantive expertise in Biology, Agriculture, Pharmaceutical, Industrial, as well as Clinical Research components. The students in this program acquire knowledge, critical thinking skills and experience in conducting cutting edge research.

### **Programme Specific Outcomes (PSOs):**

**PSO1:** The objective of the Graduation Program in Industrial Microbiology is to equip the students to gain bimolecular knowledge and analytical skills at an advanced level.

**PSO2:** The program emphasizes to apply knowledge acquired about prokaryotic and eukaryotic cellular processes, interaction of microorganisms among themselves, with physical and chemical agents and higher order organisms in environment and biological systems to various conditions.

**PSO3:** The laboratory training in addition to theory is included so that the students will acquire the skills to qualify for a broad range of positions in research, industry, consultancy, education and public administration, or for further education in a doctoral program.

**PSO4:** Students will be able to address broad range of fields including biopolymer chemistry, marine biochemistry, environmental biotechnology, food science, microbiology, microbial genetics, molecular biology and systems biology.

**PSO5:** State of art knowledge about various methodological and analytic approaches that are used within the specialization.

**PSO6:** Knowledge of the leading edge in a chosen specialized area of Microbiology, based on own research experience from a master's project and international literature.

**PSO7:** Can compete in national level competitive exams such as NET-JRF or GATE or International exams such as GRE-TOEFEL and can pursue career in higher studies.

**PSO8:** In-depth knowledge in the structure of a repertoire of microorganisms, metabolism in the cell, knowledge of the concepts of molecular genetics and biosynthesis of proteins, enzymology, physiology, microbial pathogenicity, environmental and agricultural microbiology, genetic engineering, bioengineering and a good theoretical and practical insight into methods used to obtain this knowledge.

**PSO9:** Demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments.

**PSO10:** Develop ability to independently carry out a complete scientific work process, including the understanding of theoretical background, hypothesis generation, collection and analysis of data, and interpretation and presentation of results.

**PSO11:** Has high competence and multidisciplinary project experience within selected topics related to microbiology and ability to contribute in a multidisciplinary team.

**Course Outcomes:** On the successful completion of the subject, the student get an overall understanding of cellular organization, life cycle and economic importance of prokaryotic (Eubacteria, Archaea, Cyanobacteria) and Eukaryotic (Algae, Fungi and protozoans), structure of atoms, molecules and chemical bonds, Gains knowledge on enzyme kinetics. Understands biopolymers and metabolic reaction in the living systems. To understand Cellular structure, biostatics analysis, Genetics analysis, to provide the core principles and specialized knowledge of Carbohydrates, Lipids, Proteins, Vitamins, Porphyrin, cellular transport, law of thermodynamics, Lipid and Nitrogen metabolism and usage of instruments in experiments for future research.

### **COS1: Industrial Microbiology**

- Get equipped with a theoretical and practical understanding of Industrial Technology.
- Appreciate how microbiology is applied in manufacture of industrial products.
- Know how to source for microorganisms of industrial importance from the environment.
- Know about design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer.
- Understand the rationale in medium formulation & design for microbial fermentation, sterilization of medium and air.
- Appreciate the different types of fermentation processes.
- Understand the biochemistry of various fermentations.
- Identify techniques applicable for Improvement of microorganisms based on known biochemical pathways and regulatory mechanisms.
- Comprehend the techniques and the underlying principles in downstream processing.

### **COS2: General Microbiology & Microbial Physiology**

- Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures.
- Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea.
- Know various Culture media and their applications and also understand various physical and chemical means of sterilization.
- Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae.

- Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively.
- Comprehend the various methods for identification of unknown microorganisms.
- Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy.
- Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

### **COS3: Cell Biology**

- Understand the importance, evolution and diversity of cells.
- Learns to visualize the cells by employing different types of microscopes.
- Able to describe the organization, structure and functions of cell organelles.
- Understand the biochemical pathways associated with the cellular organelles.
- Rationalize different transport mechanisms occurring in the cell.
- Understand the cell signaling mechanisms.
- Perceive over all mechanism of cell growth and cell cycle and division.
- Understand the sequential events that occur during mitosis and meiosis.
- Introduce the concepts of stem cell and cell culturing techniques.
- Sensitized on cancer types, oncogenes and tumor suppressor genes.

### **COS4: Bioenergetics and Metabolism**

- Describe the concepts of electrolytes and electrolytic dissociation, pH and its biological significance, buffers, Henderson-Hasselbalch equation, biological buffer systems and their importance.
- Understanding the laws of thermodynamics, concepts of entropy, enthalpy and free energy changes and their application to biological systems and various biochemical studies and reactions.
- Conceptual knowledge of aerobic and anaerobic respiration and various intermediary mechanisms involved, oxidative phosphorylation.
- Overview of major biomolecules –carbohydrates, lipids, proteins, aminoacids, nucleic acids, classification, structure, function of the above mentioned biomolecules.
- Discuss the biosynthesis and the degradation pathways involved.
- Specify the biological significance of biomolecules in metabolism.
- Conceptual knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation, enzyme engineering, Application of enzymes in large scale industrial processes.

### **COS5: Molecular Biology and Microbial Genetics**

- Know the terms and terminologies related to molecular biology and microbial.
- Understand the properties, structure and function of genes in living organisms at the molecular level.
- Explain the significance of central dogma of gene action.

- Have a conceptual knowledge about DNA as a genetic material, enzymology, and replication strategies.
- Understand the molecular mechanisms involved in transcription and translation.
- Describe the importance of genetic code and wobble hypothesis.
- Discuss the molecular mechanisms underlying mutations, detection of mutations and DNA damage and repair mechanisms.
- Explain the concept of recombination, linkage mapping and elucidate the gene transfer mechanisms in prokaryotes and eukaryotes.
- Handle and independently work on lab protocols involving molecular techniques.

### **COS6: Immunology**

- Demonstrate an understanding of key concepts in immunology.
- Understand the overall organization of the immune system.
- Conceptualize how the collection of individual clones of lymphocytes (termed the “immune repertoire”) arises from rearrangement within two genetic loci: the Ig gene in B cells and the antigen receptor in T cells.
- Learn how “clonal selection” allows for the expansion of a limited number of antigen-recognizing lymphocytes in response to a specific antigenic stimulus.
- Begin to appreciate the significance of maintaining a state of immune tolerance sufficient to prevent the emergence of autoimmunity.
- To understand about Tumor Immunology and help the students to understand its immune prophylaxis and immune therapy.
- To make them understand the salient features of antigen antibody reaction & its uses in diagnostics and various other studies.
- Learn about immunization and their preparation and its importance.
- Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read graphs, and understand and use information from scientific papers.
- Demonstrate skill in communication of scientific data in standard format.

### **COS7: Biostatistics & computer**

- Students can apply basic concept of biostatistics for various research purpose.
- Understand simple calculations.
- How to plan and execute research designs.
- Analyse data, interpret, and present information.
- Publishing research data Calculate; analyse and compare observed data; perform simple sums in proportions and algebraic function.

### **COS8: Biosafety and Bioethics**

- Detailed description on global status of genetically engineered crops, Asimolar conference on rDNA technology.
- Brief description on the concerns of GE crops – animal and human health, environment, agriculture, horizontal gene transfer and general concerns.



- Principles of safety assessment of transgenic plants and sequential steps in risk assessment.
- Concepts of familiarity and substantial equivalence.
- Environmental risk assessment and food and feed safety assessment.
- International biosafety regulations, Cartagena protocol, OECD consensus documents and Codex Alimentarius.
- Indian biosafety regulations, Biosafety research trials and GM labeling.
- Brief description on bioethics, ethical issues on GM crops, Nuffield council on bioethics.

### **COS9: Patents, IPR and Biosafety**

- Patent laws and patent types, procedures for patent filing.
- Concept of Intellectual property rights, commercialization of any inventions in the biotechnology sector.
- Concept of Biosafety regulations in development and handling of recombinant microbial products.

### **COS10: Industrial waste management**

- Concept of Industrial waste management system, Types of waste (Solid, liquid, air, toxic, medical, radioactive) and their management.
- Different methods of bioremediation of various types of industrial waste. Concept of xenobiotics and their management, Concept of environmental monitoring of air pollution and their management.

### **COS11: Skill Development**

- Capacity building and skill development of the students in planning, development, formulation, monitoring and evaluation of project for entrepreneurial proficiency.
- Learn specific techniques on Plant Biotechnology/Bioinformatics and get hands-on training on the research theme of the host industry/institution.
- Develop communication skills through inter-personal interactions with lab members at the host institute and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

### **COS12: Project formulation, Execution and Presentation**

- Students learn to analyse the researchable problems and devised strategies to overcome in project mode.
- Formulate project proposal with key indicators for monitoring the progress.
- Learn to execute the project and perform mid-term corrections as alternative strategies.
- Helps students learn general conduct and discipline of working in team environment in lab.

- Inculcates creativity in the execution of the project and presentation.

### **COS13: Educational Tour**

- Exposure to leading national and international institutions and their working environment and the state-of-the-art facilities.
- Learn on the different agro-climatic zones across India and the cropping pattern in various parts of India.
- Develop communication skills by interactions with their faculty and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

### **Entrepreneurial Development in Microbiology**

- Entrepreneurial Development in Industrial Microbiology for a period of 10 weeks On-campus/Off-campus in one of the following skill development courses based on students interest.
- Students learn tools and techniques in various modules of Industrial Microbiology.
- Perform procedures for the De novo and reference based assembly, Genome finishing and annotation.
- Develop ability to plan and perform experiments.
- Inculcates the team learning environment when students are posed with challenging tasks.
- Ability to formulate winning project proposals for establishing independent firms.
- Knowledge on resource mobilization, cost analysis and economics of the project.

### **➤ Industrial Microbiology Learning Outcomes**

- ✓ **Cognitive Knowledge:** To provide education that leads to comprehensive understanding of the principles and practices of biotechnology.
- ✓ **Information and Computer Literacy:** To educate and make them up to date with the current scientific literature, computer programs and web information.
- ✓ **Experimental Skills:** To provide broad based training in technical skills in methods of biotechnology.
- ✓ **Critical Thinking:** To empower students with the ability to think and solve problems in the field of biotechnology.

- ✓ **Scientific Communication:** To ensure students are able to effectively communicate with biotech and other interdisciplinary professionals.
- ✓ **Professional Attitude:** To produce responsible biotechnologists that can work within the interdisciplinary framework of biotechnology and related fields.

### **Program Outcome B.Sc. Home Science I year**

PO1: This course helps to understand about Food, Nutrients, their requirement, effect of deficiencies and excess in the body .Use of appropriate methods of cooking to improve the nutritional quality of food.

PO2: The students can understand major environmental issues with development of environmental consciousness to check various environmental threats.

PO3: Guidance regarding marriage and family system, its concepts, goals and areas of adjustment is explained to the students for well-adjusted family life.

PO4: Importance of clothing for protection, comfort, different personality traits and growth pattern is explained to the students, so that they can establish their own fashion industry.

PO5: The structure of rural and urban communities and their socioeconomic conditions are taught to the students so that they can recognize their role in the overall development of the community.

PO6: The main thrust area of this subject is provision of holistic education with professional and Qualitative development of individuals and families.

PO7: Importance of computer application for education and research is emphasized by training the students in this field.

### **Program Specific Outcome B.Sc. Home Science I year**

PSO1: Group II Paper A- Basic Nutrition

- The students are guided to develop the ability to select food items according to requirement of the body for health and freedom from disease.
- It creates awareness about the factors that influence and stimulate growth and development during the lifespan.
- To enable the students to understand the relationship of nutrition to health.
- To enable the students to understand Digestions, absorption and metabolism of different Nutrients.

PSO2: Group II Paper B – Introduction to Resource Management

- The students are guided about wise use of resources to achieve goals.
- The students are sensitized about the impact of human activities on environment and the actions to be taken to check the environmental threats.

PSO3: Group III paper A – Human Development

- The students learn about the Physical Motor, Cognitive, Language, Social and Emotional Development from the period of Conception to Adolescence.
- They get Knowledge of Family and Child Welfare Programs.

PSO4: Group III Paper B – Textile and Clothing

- Students are guided about choice of Fabrics, clothing construction and different textiles.

PSO5: Group IV paper A- Community Development

- The subject helps the students to understand the meaning of social change and ongoing development plans and programmes for Overall development of the community and the role of non-government organizations in community development.

PSO6: Group IV paper B - Personal Empowerment and Computer Basics

- The students become aware of the interdisciplinary Approach of home science education and its potential for personal and professional enhancement.
- Students learn about basics of computers and their use for education information and research.

### **Course Outcome B.Sc. Home Science I year**

Group II Paper A- Basic Nutrition

CO1: To understand the importance of balance diet, types of nutrition, nutrients and their relationship to health.

CO2: To Develop the Concepts of macronutrients protein, fat, carbohydrate and fibers and their importance.

CO3: To summarize the importance of micronutrients, fat-soluble vitamins their functions.

CO4: To explain the structure, composition, Classification and functions of various foods such as milk, meat, fish, poultry and beverages.

CO5: To explain different methods of Improving the nutritive value of foods.

Practical:-

To acquire skills in food preparation techniques and also use the appropriate methods of cooking for preparation of specific food products.

Group II Paper B – Introduction to Resource Management

After completion of this course the students would be able to:

CO1: Describe the family resource management.

CO2: Identify the motivating factors of management.

CO3: Enlist the steps involved in decision making.

CO4: Explain the management process.

CO5: Explain the proper management of time and energy.

Group III paper A – Human Development

CO1: To understand the importance of studying human development, its relationship to Heredity and Environment and Constraints and facilitators of growth and development.

CO2: To summarize the physical development from the period of conception to adolescence and its relationship to motor development.

CO3: To explain the concept of intelligence, stages of cognitive development, a communication process and the factors affecting their development.

CO4: To Describe the importance of socialization in Development, social milestones, personality traits and Types of personality.

CO5: To develop the concept of marriage and associated goals, rituals, Functions and challenges, mate selection, marital adjustment, Planned Parenthood, Marital disharmony and rehabilitation policies and programmes.

Practical:-

To understand growth pattern of children between 1 to 3 years of age, immunization schedule and weaning foods etc.

Group III Paper B – Textile and Clothing

After completion of this course the students would be able to:

CO1: Classify the textile fibers.

CO2: Develop different types of weaving skills.

CO3: Describe textile finishes.

CO4: Identify dyeing of different fabrics.

CO5: Describe the types of printing methods.

Group IV paper A- Community Development

After completion of this course the students would be able to:

CO1: Describe community development program in India since Independence.

CO2: Identify support structure for the development of community.

CO3: Identify the role of audio visual aids in the development of community.

CO4: Explain the problem of poverty and recall alleviation program.

Group IV paper B - Personal Empowerment and Computer Basics

After completion of this course the students would be able to:

CO1: Describe the personality development – factors and influences.

CO2: Identify the capacity building aspects for women.

CO3: Explain interdisciplinarity of Home-Science.

CO4: Explain the contemporary issues in the society.

CO5: Identify the devices and components of Computer.

### **Program Outcome B.Sc. Home Science II year**

POS1: The subject Clinical Nutrition helps the students to understand the concept of balance diet, adaptation of normal diets, RDA according to different periods of life cycle and physiological

conditions. Practical knowledge about dietary management in common ailments is also imparted to the students.

PSO2: Students are introduced with basic styling and pattern drafting. Basic techniques of clothing construction are also taught to the students.

PSO3: Nutritional problems and their health implications, ongoing prophylaxis programmes to combat nutritional problems in India are discussed with the students.

PSO4: Process, methods and importance of Communication are explained to the students.

PSO5: Students can understand the significance of various creative activities by creating play material and designing learning equipment's.

PSO6: Students are made aware of consumer rights, responsibility and also about consumer protective services.

### **Program Specific Outcome B.Sc. Home Science II year**

PSO1: Group II paper A - Clinical Nutrition and Dietetics

- Study of relationship between health and nutrition is provided to the students.
- Students are taught about the dietary management in common ailments and Therapeutic adaptation of normal diet.

PSO2: Group II paper B - Textile and Fiber science

- Students learn to select the fabric for dress according to climate, age, occupation, occasion, personality, figure type and fashion etc.

PSO3: Group III paper A - Human Physiology and Community Nutrition

- Students become aware of the anatomy and physiology of the body, different systems and their functions.
- Nutritional problems of the community, and the prophylaxis programmes to combat nutritional problems are also explained to the students.

PSO4: Group III paper B - Communication Process

- Practical training is imparted to the students by organizing group discussions, planning of an educational program, and preparation of drama based on social development.
- How to use different Media for effective communication, catering to the needs and interests of the community is taught to the students.

PSO5: Group IV paper A - Lifespan Development

- The students Become acquainted with developmental stages from conception to old age.
- Students learn about how to promote creativity by the use of low-cost available material for optimum development of children.

PSO6: Group IV Paper B – Consumer Economics

- The students are guided to develop the ability to proper management of income.
- It creates awareness about the buying problems in the market and its related protection laws.
- The subject helps the students to learn about consumer protection services.

- To enable the students to understand saving and source of investment.

### **Course Outcome B.Sc. Home Science II year**

#### Group II paper A - Clinical Nutrition and Dietetics

CO1: To summarize the relationship of Nutrition and Health, Energy Requirement, Diet and Meal Planning according to age, sex, activity, BMR and SDA.

CO2: To describe the nutritional requirement and nutritional problems in Adulthood, Pregnancy, Lactation and Old-Age etc.

CO3: To explain the principles of diet therapy and modification of normal diet for therapeutic purposes.

CO4: To understand the etiology and dietary management of Gastrointestinal, Liver and Joint disorders.

CO5: To develop the knowledge of importance of Therapeutic diet in Endocrine and Vascular disorders.

Practical:-

To Plan and prepare Normal and Therapeutic Diet in relation to Special conditions and Nutrient Requirements.

#### Group II paper B - Textile and Fiber science

After completion of this course the students would be able to:

CO1: Explain the principles of laundry.

CO2: Acquaint the knowledge of washing of different kinds of fabrics.

CO3: Classify the techniques of stain removal.

CO4: Explain the clothing construction equipment.

CO5: Draft and drape different types of garments.



### Group III paper A - Human Physiology and Community Nutrition

After completion of this course the students would be able to:

- CO1: Recall the concept of cell, tissues, and heart.
- CO2: Acquaint the knowledge of digestion and absorption process of food.
- CO3: Describe the excretory and respiratory system.
- CO4: Recognize the concept of muscular skeletal system and reproductive system.
- CO5: Identify the nutritional problems of community in India.

### Group III paper B - Communication Process

After completion of this course the students would be able to:

- CO1: Explain the importance of communication in development.
- CO2: Perform written and oral communication effectively.
- CO3: Identify the methods of communication.
- CO4: Demonstrate the problem or methods by identifying, explaining and applying current information.
- CO5: To enlist different media for development of communication.

### Group IV paper A - Lifespan Development

CO1: To understand the need to study Development during the life-cycle and inter-relationship between the aspects of Development.

CO2: To explain the developmental tasks of Adolescence and the problems associated with this age.

CO3: To describe the Developmental Tasks, responsibilities, stress, health issues and adjustment in Early, Middle and Late Adulthood.

CO4: To summarize activities from Infancy to toddlerhood.

CO5: To describe the concept of creativity and the role of various art activities and other material in its development.

Practical:-

To describe and list activities for children (6 months to 26 months) and develop play material suitable for each age group.

### Group IV Paper B – Consumer Economics

After completion of this course the students would be able to:

- CO1: Define the consumer right and responsibility.
- CO2: Manage income saving and investment.

CO3: Identify buying motives and channels of distribution.

CO4: Explain consumer protection services.

CO5: Aware aids for decision making.

### **Program Outcome B.Sc. Home Science III year**

PO1: The students will be having knowledge of diversified subjects of Human life.

PO2: The students will be able to excel in personality development and communication skills.

PO3: The students of this faculty have interdisciplinary knowledge, so they can express their skills in many professions.

PO4: The students will be able to effectively discuss, exchange thoughts and views by connecting through electronic media.

PO5: The students will have concepts about importance of food and nutrients in daily life, about parenting, managing different areas, personal grooming and other social issues and can easily and skillfully manage critical and creative activities.

### **Program Specific Outcome B.Sc. Home Science III year**

#### Group II Paper A – Nutritional Biochemistry

PSO1: Studying the biochemistry of nutrition can cover vital information about the role of diet plays in the establishment, development and prognosis of physical diseases such as cancer, diabetes, heart disease, and stroke illnesses that have been linked in some way to diet and nutrition.

PSO2: Nutritional Biochemistry deals with various studies in nutrients, food constituents and their function regarding humans and other mammals, nutritional biochemistry specially focuses on nutrient chemical components, and how they function biochemically, physiologically, metabolically, as well as their impact on disease.

PSO3: In this subject the students will learn in detail about carbohydrates, lipids, proteins, enzymes, hormones, blood composition and urine formation and composition.

#### Group II Paper B – Food Preservation

PSO1: Preservation its importance, principles, and various techniques are covered in this subject.

PSO2: Effect of food processing on loss of vitamins and minerals and methods of restoration of nutrients are also taught to the students.

#### Group III Paper A – Early childhood Education

PSO1: To develop the skills and techniques to plan activities in ECCE centers of different types, to conduct activities in early childhood care and education and to work effectively with parents and community.

#### Group III Paper B: Extension Education

PSO1: The students will develop knowledge about extension education process and how to develop environment for learning and role of educators and people participants in communication process.

PSO2: The concept of formal and informal education and planning of 5 year plans their areas of concern helps students enter into Govt. planners.

PSO3: The students are given knowledge about National Food programs, Poverty alleviation programs and current programs to eradicate poverty.

PSO4: The students associated with this course have in-depth knowledge about programmes related with Women and Child welfare, information about role of NGO's help students raise the socio-economic status of the Country.

PSO5: The students are given theoretical as well as practical knowledge through workshops, visits related to advertising media indoor outdoor which can help them enter the media world and flourish in this field.

PSO6: A diversified knowledge about Govt. schemes, plans, advertising media and communication skills will develop a flourishing citizen of India.

#### Group IV Paper A – Foundation of Art & Design

PSO1: The students are guided about the elements of design.

PSO2: This subject helps the students to develop the art of home decoration in various patterns.

PSO3: It creates awareness about the factors influencing selection and purchase of site of houses.

PSO4: The students learn about the skill of house planning.

PSO5: TO enable the students to understand style, selection and arrangement of furniture.

#### Group IV Paper B – Apparel making and Fashion Designing

PSO1: The students are guided about the principles of figure drawing and solve the different types of figure problems.

PSO2: The subject helps the students to understand the principle of design for overall construction of clothing.

PSO3: The students learn to prepare the garment according to fashion.

PSO4: The subject guides the students to learn the techniques of traditional embroideries in India.

### **Course Outcome B.Sc. Home Science III year**

## Group II Paper A – Nutritional Biochemistry

After completion of this course the students would be able to:

CO1: Explain the role of carbohydrates and blood sugar regulation in human body.

CO2: Identify the functions of lipids and fatty acids.

CO3: Define protein, amino acids, and their metabolism.

CO4: Describe the biological role of the hormones.

CO5: Explain composition of blood and its functions.

## Group II Paper B – Food Preservation

After completion of the course students will be able:

CO1: To understand the causes of food Spoilage and the Principles of food Preservation.

CO2: To summarize different methods of fresh food storage. Principles of canning and nutritive value of canned foods.

CO3: To describe the use of heat treatment for preservation of food products such as pasteurization and different types of dryers.

CO4: To explain the use of low temperature i.e. Refrigeration and freezing in Food Preservation. How to establish a small scale industry.

CO5: To understand the use of chemicals, acid and sugar in the preservation of foods and their nutritional implications.

Practical:-

To explain and demonstrate different methods of preparation and preservation of food items.

## Group III Paper A – Early Childhood Education

CO1 - To teach the students regarding significance and objectives of Early Childhood Education along with various ECCE programmes.

CO2 - To become acquainted to the students about historical overview of ECCE and views of educationists.

CO3 - To teach the students regarding need and importance of curriculum and classical theories of play with importance.

CO4 - Teach the students – how to teach language and mathematics to preschoolers. Tell them Importance and Scope of Environmental Studies through experience.

CO5 - Give knowledge how to prepare project work under Early Childhood Education and methods of evaluation.

Practical –

To guide them how to teach various experience to early childhood year children like:-Science Experience, Moral Education, Creative Experiences etc. under Nursery School Teaching.

## Group III Paper B: Extension Education

CO1: After undergoing this program students can act as Extension workers, educators and communicators.

CO2: Knowledge in the field of enhancing food production and poverty alleviation programs graduates of this program can help Govt. in undergoing and reforming such programs.

CO3: The students of this program can start their own NGO's and help Govt. in raising their socio-economic status.

CO4: The graduates of this course understand different advertising media and join or start their own social media and advertising companies.

#### Group IV Paper A – Foundation of Art & Design

After completion of this course the students would be able to:

CO1: Recognize the principles of design.

CO2: Describe the principles if home decoration.

CO3: Plan house and landscape planning.

CO4: Explain the source of investment.

CO5: Organize furniture, curtains draperies and accessories at home.

#### Group IV Paper B – Apparel making and Fashion Designing

After completion of this course the students would be able to:

CO1: Identify different figure problems.

CO2: Recall the elements and principles of design.

CO3: Explain the colour scheme and fashion trends in textile.

CO4: Explain the disposals of fullness in the garment construction.

CO5: Define fundamentals and traditional embroidery.

## **FOUNDATION COURSE**

### **Course Outcome and Programme Outcome**

Keeping in views the need and importance of English in the job market both within and outside the Nation the affiliating University namely Hemchand Yadav Vishwavidyalaya has formulated a syllabus for English Language for all Undergraduate students. This Curriculum helps the students of both English and Hindi medium to enhance their communication skills and be prepared to face this Competitive World.

The lessons in the text books of all the three years in Undergraduate classes gave them an insight into Indian Culture Scientific Temper and Aspects of modern developments.

Units in paragraph writing, Expansion of Proverbs and Phrases, Precis writing, Report writing and Letter writing are all relevant in teaching the students effective written communication. The course has been thoughtfully curated to give a holistic exposure of the language not only academically but also in everyday life beyond the educational setup.

It is observed that the students who enter the institution with a resistance towards the subject and are apprehensive about it emerge empowered and confident on Completion of their graduation and making English their friend.

Special Chances on Communication Skills outside of Academic Curriculum are also conducted to help students in their Personality Development and effective Communication with the world outside and face competitive exams.

### **B.Sc./B.Com. Part III Hindi Language**

P.O. & Hkk"kk laLd`fr dk niZ.k gS fdlh lekt ;k jk"V<sup>a</sup> dh Nfc Hkk"kk esa izfrPNkf;r gksrh gSA ifjorZu izd`fr dk lgt dze gS] Hkk"kk lkekftd /kjksgj gS] vr% ifjorZu'khy gksrh gSA Lukrd r`rh; o"kZ ds ikB~;Øe esa lkfgR; dh fo/kk;sa & dfork] ,dkadh] fuca/k ,oa vusd fo"k;ksa dk ,dhd`r lEesyu gSA

P.O. & foKku ,oa okf.kT; ds fo|kffkZ;ksa dks lkfgR;d fo/kkvksa ls ifjpr djuk rFkk ys[ku 'kSyh izfrosnu ,oa fuea=.k i=ksa dh tkudkjh bl ikB~;Øe }kjk iznku dh x;hA

P.O. & dyk ds fo|kffkZ;ks dks Lukrd Lrj ij lkfgR; ds vusd :iks ds lkFk & izkS|ksfxdh uxjhdj.k] i;kZoj.k iznw"k.k] /kkj.kh; fodkl dh vfrfjDr tkudkjh nh x;hA

P.O. & okf.kT; ds fo|kffkZ;ks dks mi;qZDr fo"k; ds vfrfjDr dk;kZy;hu vkys[k] dFku 'kSyh] rduhdh lH;rk] tula[;k ÅtkZ vkSj 'kfdrekurk ds vFkZ'kkL= dk Hkh Kku dj;k x;kA

P.O. & Lukrd r`rh; o"kZ fgUnh Hkk"kk esa izfl) dfo;ksa dh dfork ds vfrfjDr le&lkef;d fofHkUu leL;kvksa ds izfr tkx:d fd;k x;k gS rFkk mUgsa lEizs"k.k dkS'ky esa izHkkoh cuk;k x;k gSA

### Specific Outcome:

S.O.C. & lqfe=kuanu iar] jke/kkjh flag fnudj dh dforkvksa ds }kjk fgUnh lkfgR; dh laiUurk dk ifjp;A "cgqr cM+k loky" }kjk eksgu jkds'k dh O;aX; {kerk ,oa laLd`fr vkSj jk"V<sup>h</sup>; ,dhdj.k ys[k MkW- ;ksxs'k vVy }kjk jk"V<sup>h</sup>; ,drk dh lqn`<+rk esa laLd`fr ds ;ksxnku dk ifjp; rFkk dFku dh fofHkUu 'kSfy;ksa ds Lo:i ,oa mnkgj.k dk Kku fn;k x;kA

S.O.C& fodkl'khy ns'kksa dh Toyar leL;k,W] izkS|ksfxdh dk uxjhj.k ij izHkko ,oa fodklRed iqufoZpkj tSls rF;ksa ls fo|kFkZ;ksa dks ifjpr djkus ds lkFk gh fofHkUu lajpukvksa ds Kku }kjk ys[ku dkS'ky dks fu[kkjus dk iz;kl fd;k x;kA

S.O.C. & vk/kqfud ;qx foKku&izkS|ksfxdh dk ;qx gS rduhdh lH;rk] i;kZoj.k iznw"k.k ds dkj.k ,oa mudk fuokj.k rFkk /kkj.kh; fodkl ,oa dk;kZy;hu i= ,oa vkys[k ys[ku esa n{krk dk fodklA

S.O.C. & fodkl'khy ns'kksa esa tula[;k foLQksV cgqr cM+h leL;k gS] mlds dkj.k ,oa nwj djus ds mik;ksa ls voxr djrs gq, vk/kqfud fo'o ls Lukrd Lrjh; fo|kFkZ;ks dks tksM+us ds fy, vuqokn dyk dk laiw.kZ foospu crk;k x;kA

S.O.C. & ÅtkZ ds Lo:i ,oa izdkj] L=ksrksa dh tkudkj iznku djrs gq, ?kVukvksa ds izfrosnu ,oa fofHkUu fuea=.k i=ksa dk izk:i crkuk ftldk fØ;kUo;u nSfud thou esa fd;k tk;sA

**Course Outcome** & Lukrd Lrj ij ns'k dh le`) lkaLd`frd fojklr le`) thou ewY;ksa dk fo'o dh le&lkef;d ?kVukvksa ds izfr Nk= txr dks tkx:d djuk rFkk fgUnh f'k{k.k dk O;kogkfjd fØ;kUo;u izfrosnu] fuea=.k lajpukvksa ds ek;/e ls muesa tkx`r djus dk iz;kl fd;k x;k gSA oSKkfud fo"i; ,oa lkfgR;d fo/kkvksa ds viwoZ leUo; ls Nk= ykHkkfUor vo'; gq, gSaA

## **B.Sc./B.Com. Part II Hindi Language**

**Programme Outcome & Hkk"kk euq";** dh loZizFke izkFkfedrk gSA Hkk"kk O;fDrRo dk ewyk/kkj gSA Lukrd f}rh; o"kZ ds ikB~;Øe }kjk fo|kffkZ;ks ds eu esa Hkk"kk dk 'kq) :i tkuus ,oa mldk O;kogkfjd iz;ksx crkus dk iz;kl fd;k x;k gSA 'kCnksa ls gh laLd`fr dk mn~xe gksrk gSA 'kCn laLd`fr ds /kkjd gSa IR; vfgalk] xzke lsok] ;qodksa dk lekt esa LFkku ekr`Hkwfe] fgeky; dh O;qRifRr] Mkw-[kwcpan c?ksy O;k[;ku }kjk cPpksa ds lkaLd`frd] ,sfrgkfld ekuoh; ewY;ksa ds o)Zu dk iz;kl fd;k x;kA

P.O. & fgUnh Hkk"kk ds fofo/k :i dk;kZy;hu Hkk"kk] ehfM;k dh Hkk"kk] foRr ,oa okf.kT; dh Hkk"kk] e'khuh Hkk"kk ds Kku }kjk mUgsa iz'kklfud ,oa dk;kZy;hu mi;ksx dh Hkk"kk dk izdk;kZRed i{k le>k;k x;kA

P.O. & vaxzsth varZjk"V^h; egRo dh Hkk"kk gS ftlds Kku ls foKku] izkS|ksfxdh] le&lkef;d tkudkj miyC/k gks ldrh gS] vr% Lukrd Lrj ij cPpksa dks vuqokn ds Lo:i ,oa izfØ;k dk Kku iznk; fd;k ftls os uO; fo'o ls ifjpr gks ldsA

P.O. & fgUnh dh O;kogkfjd dksfV;ksa dk Kku iznku dj mudh mPpkfjr ,oa fyf[kr Hkk"kk dks 'kq) ,oa vuq'kkflr djus dk iz;kl fd;k x;kA

### **Specific Outcome: fgUnh Hkk"kk**

S.O.C. & jk"V^firk egkRek xka/kh ds IR; vkSj vfgalk laca/kh fopkjksa dh tkudkj }kjk ekuo ewY;ksa dk fodkl ,oa ifji=] i`Bkadu vf/klwpuk Kkiu vkfn dk;kZy;hu i=ksa dh jpuk izfØ;k ls voxr djukA

S.O.C. & xzke&lsok O;k[;ku vkpk;Z fouksck Hkkos }kjk xzE; thou ,oa xzke lsok }kjk ns'klsok dk ewyea=fn;k ,oa jsfM;ks] Vh-oh-] lepkj i= dh Hkk"kk dk Lo:i crk;k x;kA

S.O.C. & ;qodksa dk ns'k ,oa lekt ds fodkl esa ;ksxnku" ;qodksa dh 'kfDr ,oa vf/kdkj iznku djus ls ykHk ,oa foRr&okf.kT; Hkk"kk dh fo'ks"krkvksa dk ifjp; fn;k x;kA

S.O.C. & ekr`Hkwfe ,oa fgeky; dh O;qRifRr" O;k[;ku }kjk Hkkjr ds HkkSxksfyd Lo:i ,oa ekr`Hkwfe dh egRrk dh tkudkjA



S.O.C. & e'khuh Hkk"kk ds varxZr Hkk"kk ds u;s izkS|ksfxd ,oa oSKkfud :i dh tkudkj ,oa NRrhx<+ jkT;  
ds iz.ksrk MkW- [kwepan c?ksy ds O;fDrRo ,oa d`frRo dk ifjp;A

S.O.C. & fgUnh dh O;kdjf.kd dksfV;ksa ds Kku ls Hkk"kk dk Kku 'kq) HkkokfHkO;fDr ,oa laf/k lekl]  
laf{kfIr }kjk foLr`r :i dks laf{kIr lkFkZd Lo:i iznku djus esa l{ke cukuk] laf{kfIr }kjk fopkjksa dks  
l'kDr cukukA

**II<sup>nd</sup> Course Outcome** & fgUnh gekjh ekr`Hkk"kk gSa] laidZ Hkk"kk gSA blds Kku }kjk oSpkfjd  
lEizs"k.k] HkkokfHkO;fDr l{kerc ds lkFk dh tk ldrh gSA lkekftd thou esa mfpr lek;kstu ,oa viuh fur  
uwru vko';drkvksa dks fgUnh Hkk"kk ds fu/kkZfjr Kku ls iwjk fd;k tk ldrk gSA O;fDrRo dk mUu;u  
Hkk"kk }kjk gh laHko gSA

## **B.Sc./B.Com. Part I Hindi Language**

### **Programme Outcome**

P.O. & Lukrd Lrj ij izFke o"kZ ds fo|kfFkZ;ks esa fgUnh Hkk"kk ds izfr vfHk:fp tkx`r djukA ns'k dh  
lkaLd`frd /kjksGj] lkekftd l'apuk ds izfr KkukRed psruk dk fodkIA

P.O. - Hkkjrh; lkfgR; ds xkSjo/kehZ lkfgR;dkjksa dh fofHkUu fo/kkvksa dk ifjp;A

P.O. & Hkkjrh; laLd`fr ds egkure :i ls Lukrd Lrj ds Nk=ksa dks ifjfr djuk rFkk cnyrs le; ds lkFk ifjofrZr  
lkaLd`frd ewY;ksa ds laca/k esa Kkuo`f)A

P.O. & Lukrd izFke o"kZ eq[;r% fgUnh Hkk"kk ds lEizs"k.k dkS'ky ls lacaf/kr gSA fgUnh O;kdj.k ds  
fofHkUu Lo:iksa ls ifjfr djksr gg, mUgsa 'kq) mPpkj.k ,oa 'kq) ys[ku gsrq mRizsfjr djukA

P.O. & uO; oSKkfud :iks ls vkc) fgUnh dk vuqokn ,oa dEI;wVj izkS|ksfxdh ds fofHkUu vuqiz;ksxksa dk  
Kku Lukrd Lrj ij dj;k k tkrk gSA

**Specific Outcome:**

S.O.C. & Lukrd izFke o"kZ ds fo|kfFkZ;ks dks Hkkjr oanuk] bZnxkg] Hkksykjke dk tho lkfgR; ds fofHkUu  
:iksa dk fnXn'kZu djkus ds lkFk lw;Zdkar f=ikBh "fujkyk" eqa'kh izsepan ,oa gfj'kadj ijlkBZ ds  
ys[ku dks'ky dk ifjp; nsrh gSA

S.O.C. & ikfjHkkf"kd 'kCn vuqokn i= ys[ku Nk=ks dks vk/kqfud ;qx dh t:jrkxa ds vuqlkj ifjofrZr O;kdj.k ds  
Lo:i dh tkudkj iznku djrs gSaA

S.O.C. & vusdkFkhZ] leJqr] eqgkojs yksdksfDr i;kZ;okph&foykse muds 'kCn Kku dks le`)'kkyh cukus esa  
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## **B.Ed**

### **Programmes Outcomes:**

The students will be equipped with various teaching skills, develop competencies in research, Trained to Teach in Secondary Schools and Higher Secondary Schools.

The students will be able to be highly engaged in social interactions and Elicit views of others, mediate disagreements and help reach conclusions in group settings.

It provides them with Ethics and helps them recognize different value systems including their own, understand the moral dimensions of their decisions, and accept responsibility for them.

### **Program Specific Outcomes:**

1. State and Discuss the meaning of Philosophical, Psychological and Sociological aspect of foundation in Education.
2. Discuss the Historical aspect of foundation in Education.
3. Explain the different aspects of Educational Technology.
4. Distinguish the difference among different foundations of Education.

### **Course Outcomes :**

1. Discuss the meaning, nature, scope, and aims of education.
2. Discuss the meaning and scope of educational philosophy.
3. Explain the factors of education and their relationships.
4. Describe the knowledge, reality, and value of different Indian schools of philosophy namely Sankhya, Yoga, and Buddhism.

5. Discuss the educational view of different Western schools of philosophy namely Idealism, Naturalism, Pragmatism.
6. Explain the concept of Democracy, Socialism, and Secularism.
7. Discuss the meaning, nature, and scope of Educational sociology and Relation between education and sociology
8. Describe the Social factor and their relation to Education.
9. Explain the Social change and its impact on Education.
10. Discuss the concept, nature, scope, and uses of Psychology in education.
11. Explain the influence of growth and development in education.
12. Describe the meaning and concept of learning, its theories, and factors.
13. Explain the application of learning theories in the classroom situation.
14. Discuss the concepts of measurement and evaluation in the field of education.

#### **2.6.1 Program outcomes, program specific outcomes and course outcomes**

**Bhilai Mahila Mahavidyalaya, Bhilai Nagar, Bhilai**  
**(Post Graduate Courses )**

## **M.Sc. Botany – 4 Semesters Postgraduate programme**

Programme outcome (POs) : As per Syllabus(BOS, Botany):- The M.Sc. - Botany curriculum is designed to with aims to train the students in all the areas of plant sciences with a unique combination of core and elective papers with significant interdisciplinary components. Students have exposure to cutting-edge technologies that are currently used in the subject. They are made aware about the social and environmental issues, significance of plants and their relevance to the national economy.

### **Programme Outcomes (PO) MSc Botany**

1. Botany as a field has seen a tremendous growth in recent years. A number of fields open up for botany Post graduates to excel in such as

- food companies,
- forest services,
- biotechnology,
- educational institutions,
- biological supply houses,
- national parks,
- plant resources laboratory,
- food companies,
- plant health inspection services,
- seed and nurseries companies and
- land management agencies.

2. The post graduates Botany students also can go for many fields in botany such as

- **Plant Taxonomy,**
- **Ethnobiology,**
- **Plant Pathology,**
- **Palaeobotany and Palynology,**
- **Plant cytology,**
- **Plant geneticists,**
- **Plant ecology,**
- **Plant Scientists**

- **and Weed Scientists etc.**

3. They can also go and work as **Researchers and as administrators.**
4. They have also the option in **Botanical Survey of India** and other **Government departments** but only through UPSC exams.

### **Programme Specific Outcomes (PSO)**

**PSO1.** The MSc Ist Semester students after the completion of this programme;

1. They acquire fundamental knowledge about Cytology.
2. They develop strong fundamentals basics for further cytological studies.
3. Paper provide a foundation and background in cellular structure of plants cell structure in relation to functions, eukaryotic genome structure (including nuclear and organellar), and regulatory mechanisms.
4. Designing/conducting experiments and analyzing experimental data.

**PSO2.** The MSc Ist Semester students after the completion of this programme;

1. They acquire fundamental knowledge about Genetics.
2. They understand the pattern of inheritance various life forms.
3. They understand the principle mechanisms of genome replication, maintenance, function and regulation of expression.
4. Learning molecular and technical skills along with applications of the instrumentation.
5. Designing/conducting experiments and analyzing experimental data.

**PSO3.** The MSc Ist Semester students after the completion of this programme;

1. They acquire fundamental knowledge and understand about Microbiology, Phycology and Mycology.
2. This course aims to increase the understanding of the students about the diversity of lower plants, their classification, structure, growth reproduction and life history.

**PSO4.** The MSc Ist Semester students after the completion of this programme;

1. They acquire fundamental knowledge and understand Bryophyte, Pteridophyta and Gymnosperm.
2. This course aims to increase the understanding of the students about the diversity of lower plants, first land plants, naked seed plants, their classification, structure, growth reproduction and life history.
3. Students will develop understanding about the identification, classification and economic importance of Bryophytes, Pteridophytes and Gymnospermic plants.

**PSO5.** The MSc IInd Semester students after the completion of this programme;

1. They acquire fundamental knowledge and understand Taxonomy and diversity of plants.

- 2.To understanding of the students about the plants diversity, their Description, Identification, Nomenclature and their classification including recent advances in the field.
3. The students will know about the systematic position of Generas, Species and Families.
4. The students develop knowledge about plant binomial nomenclature and herbaria.

**PSO6.** The MSc IInd Semester students after the completion of this programme;

- 1.They acquire fundamental knowledge and understand principles and fundamentals of Molecular Biology.
2. The students will be learning About the acellular entities including protein or RNA, cell being the basic unit of life or higher plants and current state of knowledge about the plant cell structure and their turn over, starting from cell wall to chromatin, in relation to their functions.
3. Students will understand about major cellular processes of plants.
5. Students will focus on various components of the eukaryotic nuclear and organellar genome, with special reference to their regulatory role in plants.

**PSO7.** The MSc IInd Semester students after the completion of this programme:

- 1.They acquire fundamental knowledge and understand principles and various physiological life processes in plants.
- 2.They will also gain about the various uptake and transport mechanisms in plants and are able to coordinate the various processes. They understand the role of various hormones, signaling compounds, thermodynamics and enzyme kinetics.
3. Students will gain knowledge about various mechanisms such as channel or transport proteins involved in nutrient uptake in plants.

**PSO8.** The MSc IInd Semester students after the completion of this programme;

- 1.They acquire fundamental knowledge and understand the essentials of Plant metabolism.
2. It focuses on the plant nutrient uptake and translocation, photosynthesis, respiration and nitrogen metabolism.
3. Student learns about the various metabolic pathways lead to the formation of significant molecules and their catabolism. It focuses upon the vital role of each of these molecules in plants.

**PSO9.** The MSc IIIrd Semester students after the completion of this programme;

- 1.They acquire fundamental knowledge and understand the essentials of Plant development and plant resources.
- 2.They know about various economically important plants.
- 3.The students acquainted with the fundamentals and present understanding of the mechanisms associated with development, differentiation and structure of various plant organs, the metabolic and physiological changes occurring in them.

**PSO10.** The MSc IIIrd Semester students after the completion of this programme;

1. Students acquire fundamental knowledge and understand the principles, essentials and fundamentals of Plant Ecology, Ecosystem and vegetation ecology, population, community and ecosystem structure and function, application of these concepts to solve environmental problems.
2. They are able to design the strategies for conservation, biological diversity, conservation, sustainable development.
4. The students will also be understand the various environmental factors governing these ecosystems are also clearly understood.
5. 3. They understand the pattern origin, diversification and cultivation of plants in nature.

**PSO11.** The MSc IIIrd Semester students after the completion of this programme;

1. They acquire fundamental knowledge and understand essentials of principles of Biotechnology I (Genetic engineering of plants & microbes), and Scope of Biotechnology.
2. This course is designed to provide a contextual and inquiry based learning of modern day advances in the field of recombinant DNA technology and modern age applications of recombinant DNA technology.
3. They also know about Fermentation Technology.
4. They understand the concept of genomics and proteomics.
5. Concepts, tools and techniques related to in vitro propagation of plants, Different methods used for genetic transformation of plants, use of Agrobacterium as a vector for plant transformation, components of a binary vector system.
6. Students will acquire understanding of basic knowledge about transgenic plants, process of development and analysis of transgenic plants, and their applications in basic and applied research.

**PSO12.** The MSc IIIrd Semester students after the completion of this programme;

1. Students acquire knowledge and understand the basic concepts, scope, principles and procedures of Molecular plant pathology-I.
2. They know about disease cycle and disease development and identify the plant diseases like bacterial, Viral, Mycoplasmal and nematodal on the basis of symptoms.
3. Account of different basis of plant disease classification.
4. Students know about effect of environmental effect of disease developments.
5. Know the methods of studying plant diseases.

**PSO13.** The MSc IVth Semester students after the completion of this programme;

1. Student will develop the understanding of reproduction (Megaspороgenesis, microspороgenesis, fertilization, development of embryo) in plants as well as understand the physiological and metabolic changes happening along with the environmental impact.
2. Students will understand about structure and function of reproductive organs and their significance in plant reproduction. Pollination, Fertilization, Embryogenesis, Aeropallinology are the areas which are stressed upon.

**PSO14.** The MSc IVth Semester students after the completion of this programme acquire;



1. Fundamental knowledge and understand the essentials, principles and procedures of Plant Ecology II (Pollution and biodiversity conservation).
2. Environmental Impact Assessment (EIA)
3. Energy resources, various types environmental pollution, water pollution and conservation strategies with sustainable management.
4. The students will be understand the factors leading to Environmental degradation, their reasons and their impact on the Environment.
5. They understand about strategies for conservation and sustainable management under the given legislative measures.

**PSO15.** The MSc IVth Semester students after the completion of this programme acquire:

1. Fundamental knowledge about essentials, principles and procedures of Biotechnology II ( Plant cell, tissue culture & organ culture).
2. They know about concept, scope, instrumentation, basic requirements and applied aspects of plant tissue culture.
2. Student will understand the basic properties of plant cell and with apply the their basic knowledge of PTC in various fields for conservation, medicine, product development, types plants tissue cultures. etc.

**PSO16.** The MSc IVth Semester students after the completion of this programme acquire:

1. Fundamental knowledge about essentials, principles and procedures of Molecular plant pathology-II.
2. They know about prevention and control measure of plant diseases; Biological and chemical control.
3. Know the concept about disease forecasting and Epidemiology: basic concept, factors, and major historical examples.
4. Study of various plant diseases caused by Fungi, bacteria, virus and nematodes.

## **Course out comes /CO M.Sc. Botany4 Semester Exam**

### **M.Sc. Botany Semester I**

#### **Paper I:- Cytology**

**CO1:-** The First semester Botany students after the completion of this course will be able to understand and describe about: dynamic cells; Structural organization of the plant cell; specialized plant cell types; chemical foundation; biochemical energetic; Cell wall - Structure and functions; biogenesis and growth; Plasma membrane; structure, models and functions, site for ATPase, ion carriers' channels and pumps; receptors.

**CO2:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Chloroplast-structure, genome organization; gene expression, RNA editing; Mitochondria; structure, genome organization; biogenesis; Plant Vacuole - Tonoplast membrane; ATPases transporters as a storage organelle.

**CO3:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Nucleus: Structure, nuclear pore; Nucleosome organization; Ribosome- Structure and functional significance; Cell cycle and Apoptosis; Control mechanisms, role of cyclin dependent kinases; Amitosis, mitosis and meiosis; karyokinesis and cytokinesis and cell plate formation; mechanisms of programmed cell death (PCD).

**CO4:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Other cell organelles: Structure and functions of microbodies; microtubules; microfilaments; Golgi apparatus; lysosome; endoplasmic reticulum; Techniques in cell biology: Immune techniques; in situ hybridization to locate transcripts in cell types; Electron microscope; camera lucida; micrometry- stage and ocular microtome principles

### **MSc Botany Semester I**

#### **Paper:- II:- Genetics**

**CO1:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Chromatin Organization: Chromosome structure and packaging of DNA; molecular organization of centromere and telomere; nucleolus and ribosomal RNA genes; chromatin and heterochromatin; Karyotype and ideogram; banding pattern; specialized types of chromosomes; polytene; lamp brush;  $\beta$  chromosomes and sex chromosomes.

**CO2:-**The First semester Botany students after the completion of this course will be able to understand and describe about: Mapping of Bacteriophage genome, Phage phenotype, recombination in phage, genetic transformation and transduction in bacteria. • Molecular basis of chromosome pairing, chromosomal aberration and polyploidy.

**CO3:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Genetic recombination & genetic mapping; Mechanism of crossing over; molecular mechanism of recombination; role of enzymes in recombination; site specific recombination; linkage; linkage group; genetic marker; Tetrad analysis in *Neurospora crassa*.

**CO4:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Plant breeding technique: Introduction, selection (pure line, mass, bulk);emasculatation; bagging; tagging; hybridization (self / cross); mutation; resistant and susceptible; heterosis; inbreeding depression; chimera; Alien gene transfer through chromosome manipulation; Transfer of whole genome examples from Wheat; Arachis & Brassica; Transfer of individual chromosomes & chromosome segment; methods for detecting alien chromatin production.

## **MSc Botany Semester I**

### **Paper:- III:- Microbiology, Phycology and Mycology**

**CO1:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Archaeobacteria and Eubacteria: General account, ultra structure, nutrition and reproduction; biology and economic importance; Cyanobacteria: Salient feature and biological importance.

**CO2:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Viruses: Characteristics and ultra-structure of virions; isolation and purification of viruses; chemical nature; replication; transmission of viruses; economic importance; Prions; viroids (PSTV); virusoids; Phytoplasma and Mycoplasma: General characteristic and role in causing plant diseases.

**CO3:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Phycology : Algae in diversified habitats (terrestrial, freshwater, marine, parasite, symbiotic, epiphytic, endophytic, endozoic); thallus organization; cell ultra-structure, reproduction (vegetative, asexual,sexual); Criteria for classification of Chlorophyta; Xanthophyta; Bacillariophyta; Phaeophyta and Rhodophyta; Economic importance of algae; Pigmentation in algae; Perennation in algae; Evolution and development of sex in algae

**CO4:-** The First semester Botany students after the completion of this course will be able to understand and describe about: Mycology : General characters of fungi, substrate relationship in fungi; cell structure unicellular and multicellular organization; cell wall composition, nutrition (saprobic biotrophic, symbiotic) reproduction; (vegetative, asexual, sexual) heterothallism;

heterokaryosis; Para sexuality; recent account of Mastigomycotina; Zygomycotina; Ascomycotina; Basidiomycotina; Deuteromycotina; fungi as biocontrol agent; economic importance of fungi; Mycorrhiza; VAM fungus

## **MSc Botany Semester I**

### **Paper:- IV:- Bryophyta, Pteridophyta and Gymnosperm**

**CO1:-**The First semester Botany students after the completion of this course will be able to understand and describe about: Bryophyta : morphology; structure; reproduction; life history; distribution; classification; General account of Marchantiales; Jungermanniales; Anthocerotales; Sphagnales; Funariales and Polytrichales; Economic and ecological importance; Progressive sterilization of sporogenous tissue in bryophytes; Spore dispersal mechanism in bryophytes; Thallus organization of bryophytes; Progressive and reduction theory of origin and development in bryophytes

**CO2:-**The First semester Botany students after the completion of this course will be able to understand and describe about: Pteridophyta: morphology; anatomy and reproduction; classification; evolution of stele; Telome theory; concept of first vascular plants Homospory; Heterospory and origin of seed habit; General account of fossil pteridophyta; Prothallus organization Introduction to Psilopsida; Lycopsida; Sphenopsida and Pteropsida.

**CO3:-** The First semester Botany students after the completion of this course will be able to understand and describe about: General characters of gymnosperm mentioning diversity; Classification of gymnosperm; Resemblances and difference amongst gymnosperm; pteridophyta and angiosperm; Gymnosperm distribution in India; Gymnosperm Biotechnology; Economic importance of gymnosperm; Structure and theories regarding origin of Paleozoic ovule.

**CO4:-** Extinct gymnosperm : general account of pteridospermales; Glossopteridales; Caytoniales; Pentoxylales; Extant gymnosperm; Cycadales; Ginkgoales; Coniferales; Ephedrales; Gnetales; and Welwitschia

## **MSc Botany Semester II**

### **Paper 1:- Taxonomy and diversity of plants**

**CO1:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Plant nomenclature; Historical background of nomenclature; Binomial Nomenclature; International code of Botanical nomenclature; Plant identification: Herbaria; Botanical gardens; Taxonomic literature; Taxonomic- keys; Taxonomic hierarchy - Major categories; minor categories, species concept; Taxonomic evidences – Morphology; Anatomy; Palynology; Embryology; Cytology; Phytochemistry; Genome analysis and Nucleic acid hybridization.

**CO2:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Pre Darwinian Classification Based on form relationship (Bentham and Hooker); Post Darwinian classification Engler and Prantl, Bessey's, Hutchinson, Takhtajan and Cronquist; Recent modifications : Dahlgren's system of classification; Fossil angiosperm.

**CO3:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Study of following families with particular reference to systematic position, phylogeny, evolutionary trends and economic importance; Polypetalae: Ranunculaceae; Magnoliaceae; Nymphaeaceae; Brassicaceae; Sterculiaceae; Meliaceae; Moringaceae; Fabaceae; Myricaceae; Cucurbitaceae; Apiaceae (Umbelliferae); Gamopetalae: Rubiaceae; Asteraceae; Sapotaceae; Oleaceae; Asclepiadaceae; Solanaceae; Bignoniaceae; Verbenaceae; Lamiaceae (Labiatae)

**CO4:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Study of following families with particular reference to systematic position; phylogeny; Evolutionary trends and economic importance; Monochlamydae- Nyctaginaceae; Amaranthaceae; Polygonaceae; Euphorbiaceae; Moraceae; Casuarinaceae; Monocot families- Orchidaceae; Iridaceae; Amaryllidaceae; Scitamineae; (Musaceae) Zingiberaceae; Cannaceae; Liliaceae; Commelinaceae; Palmae (Aracaceae); Araceae; Cyperaceae; Poaceae (Graminae) study of local available familiar plants.

## **MSc Botany Semester II**

### **Paper 2:- Molecular biology**

**CO1:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: RNA and DNA Structure; A, B, C and Z Forms of DNA; HnRNA; mRNA; tRNA; rRNA; exon; intron; split gene; junk DNA; DNA replication; damage and repair.

**CO2:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Transcription; translation in prokaryotes and eukaryotes; Molecular Cytogenetics: Nuclear DNA content; C-value paradox; Cot curve and its Significance; Restriction mapping - concept and techniques; Multigene families and their evolution.

**CO3:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Gene structure and expression; fine structure of gene; Cis-trans test; fine structure analysis of eukaryotes; introns and their significance; RNA splicing; regulation of gene expression in prokaryotes and eukaryotes; Protein sorting: Targeting of proteins to organelles.

**CO4:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Mutation: Spontaneous and induced mutation; physical and

chemical mutagens molecular basis of gene; transposable elements in prokaryotes and eukaryotes mutation induced by transposones; site directed mutagenesis Inherited human diseases and defects in DNA repair; translocation, intersect Robertsonian translocation; B-Atranslocation.

## **MSc Botany Semester II**

### **Paper 3:- Plant physiology**

**CO1:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Membrane transport and translocation of water and solutes: Plant-water relation; physical and chemical properties of water; imbibitions; osmosis; diffusion; DPD; OP; TP; WP; plasmolysis (Incipient, evident and limited); deplasmolysis; mechanism of water transport through Xylem; root microbe interaction in facilitating nutrient uptake; Comparison of xylem and phloem transport; phloem loading and unloading; passive and active solute transport; membrane transport system.

**CO2:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Signal Transduction :Overview; receptors and G proteins; Phospholipids signaling; role of C-AMP; calcium-calmodulin cascade; diversity in protein kinases and phosphatases; specific signaling mechanism- two component sensor regulatory system in bacteria.

**CO3:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Stress physiology :mineral nutrition in plants (excess and deficiency); Plant responses to biotic and abiotic stress; mechanism of biotic and abiotic stress tolerance; HR Fundamental and SAR; water deficit and drought resistance; salinity stress; metal toxicity; freezing and heat stress; oxidative stress.

**CO4:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Sensory photobiology; History of discovery of phytochromes and cryptochromes and their photo chemical and biochemical properties; Photophysiology of chloroplast under light responses; cellular localization, and molecular mechanism of action of enzyme; The flowering process:- Photoperiodism and its significance; endogeneous clock and its regulation; floral induction and development; Genetic; molecular analysis; role of vernalization.

## **MSc Botany Semester II**

### **Paper 4:- Plant metabolism**

**CO1:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Photosynthesis : General concepts and historical background; evolution of photosynthetic apparatus; photosynthetic pigments and light harvesting complexes;

photo oxidation of water; mechanism of electron and proton transport; Carbon assimilation; the Calvin cycle; photorespiration and its significance; the C<sub>4</sub> cycle; the CAM pathway; biosynthesis of starch and sucrose; physiological and ecological considerations.

**CO2:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Respiration and lipid metabolism; Overview of plant respiration; aerobic and anaerobic; glycolysis; Fermentation; Krebs' cycle (TCA cycle); electron transport and ATP synthesis; Pentose phosphate pathway; alternative oxidative system; structure and function of lipids; fatty acid biosynthesis; synthesis of membrane lipids; structural lipids and storage lipids and their catabolism; Glyoxylate cycle.

**CO3:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Nitrogen and Sulphur metabolism: Overview; biological nitrogen fixation; nodule formation and nod factors; nif gene; nitrogenase; leghaemoglobin; mechanism of nitrate uptake and reduction; ammonium assimilation; sulphur uptake; transport and assimilation; nitrogen cycle; sulphur cycle.

**CO4:-** The Second semester Botany students after the completion of this course will be able to understand and describe about: Plant growth regulators and elicitors : Physiological effects and mechanism of action of auxins; gibberellins; cytokinins; ethylenes; abscisic acid; brassinosteroid; polyamines; jasmonic acid and salicylic acid; hormone receptors; Movements in plants-types and its measurement; Fundamentals of enzymology : Structure and nature of enzymes; inhibitions; General aspects of allosteric mechanism; regulatory & active sites; isozymes; kinetics of enzymatic catalysis; Michaelis-Menton equation and its significance.

### **MSc Botany Semester III**

#### **Paper-1: Plant development and plant resources**

**CO1:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: Introduction: Unique features of plant development; Metabolism of nucleic acids; proteins and mobilization of food reserves; tropisms; control of cell division; Programmed cell death in the life cycle of plants; Seed germination; Hormonal control of Seedling growth; Seed dormancy; Over coming of seed dormancy; Bud dormancy; Root development : Organization of root apical meristem (RAM); Cell fates and lineages; Vascular tissue differentiation of root; Lateral roots; Root hairs, Root microbe interaction.

**CO2:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: Shoot development : Organization of shoot apical meristem (SAM); Cytological and molecular analysis of SAM; Control of tissue differentiation; especially Xylem and Phloem, Vascular cambium; Secretary ducts and laticifers; Wood development in relation to environmental factors.

**CO3:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: Leaf development : Development; Phyllotaxy; Control of leaf form; Differentiation of epidermis (with special reference to Stomata and Trichome) and Mesophyll cell; Senescence; Influences of hormones and environmental factors on senescence; Flower development : Floral characteristics; Flower development; Genetics of floral organ differentiation: Homeotic mutant in Arabidopsis and Antirrhinum; Sex determination.

**CO4:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: Plant resources : Origin; Evolution; Cultivation and Uses of (i) Food; Forage and Fodder crops; (ii) Fiber crops; (iii) Medicinal and Aromatic plants; (iv) Vegetable Oil-yielding crops (v) fruits; Important fire-wood; Timber-yielding plants and Non-wood forest products (NFPs) such as bamboos, gums, tannins, dyes and resins.

### **MSc Botany Semester III**

#### **Paper-2: Ecosystem and vegetation ecology**

**CO1:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: ECOSYSTEM ORGANISATION:- Structure and functions; primary production (Methods of measurement, global pattern, controlling factors); Energy dynamics (trophic organization; energy flow pathways; ecological efficiencies); Litter fall and decomposition; (mechanism, substrate quality, and climatic factors); global biogeochemical cycles of C, N, P, and S, mineral cycles (pathways, processes and budgets) in terrestrial and aquatic ecosystems.

**CO2:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: ECOSYSTEM STABILITY AND MANAGEMENT Concept (resistance and resilience); Ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion; environment impact assessment; ecosystem restorations; Concept of Sustainable development; sustainability indicators.

**CO3:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: VEGETATION ORGANISATION:- Concepts of community and continuum; analysis of communities (analytical and synthetic characters); Community coefficients; inter specific associations; ordination; and concept of ecological niche.

**CO4:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: VEGETATION DEVELOPMENT :- Temporal changes (cyclic and non cyclic); mechanism of ecological succession (relay floristic and initial floristic composition; facilitation; tolerance and inhibition models); change in ecosystem properties during succession.



## **MSc Botany Semester III**

### **Paper-3: Biotechnology and genetic engineering of plants and microbes**

**CO1:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: BIOTECHNOLOGY - Basic concepts; principles and scope; RECOMBINANT D.N.A. TECHNOLOGY : Gene cloning principles; Tools - Restriction Endonucleases; DNA modifying enzymes; Choice of Vectors; Plasmid; Cosmid; Bacteriophage vectors; phagmids; Artificial chromosomes; Shuttle vectors; Yeast vectors; Expression vectors and techniques, construction of genomic / cDNA libraries.

**CO2:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: MICROBIAL GENETIC MANIPULATION: Bacterial transformation; selection of recombinants and transformants; genetic improvement of industrial microbes and nitrogen fixers, fermentation technology; GENETIC ENGINEERING OF PLANTS : Aims, strategies for development of transgenies (with suitable examples); Gene transfer methods - Vector mediated gene transfer-Agrobacterium the natural genetic engineer; t-DNA mediated DNA transformation; Virus mediated gene transfer; Vectorless or direct DNA transfer.

**CO3:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: DNA SYNTHESIS AND SEQUENCING : Chemical synthesis of gene; Polymerase chain reaction, its variation; application; advantages and limitations; DNA sequencing - Sanger and Coulson method; Maxam Gillbert method; High throughput DNA sequencing; DNA finger printing.

**CO4:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: GENOMICS AND PROTEOMICS : Genetic and physical mapping of genes; molecular markers for introgression of useful traits; Transposon mediated gene tagging; genome projects; bioinformatics; functional genomics; microarrays; protein profiling and its significance.

## **MSc Botany Semester III**

### **Paper-4: Elective course-- molecular plant pathology-I**

**CO1:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: Introduction and history of plant pathology; General Principles of plant pathology and classification of plant diseases; Diseases inciting organisms - Animal Pathogens- fungi; Bacteria; Mycoplasma; Viruses; Nematodes; their general characteristics; heterotrophic behaviour with emphasis on parasitism ability and virulence.

**CO2:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: Disease Syndrome and General Symptoms of plant diseases : Pathogenic and nonpathogenic; Symptoms caused by fungi, Bacteria, Viruses, Mycoplasma and Nematodes. 2. Sources of Infection : Seeds, soil, water and airborne diseases of plants; Significance of phyllosphere and rhizosphere studies. 3. Pathogenesis - Dissemination of plant pathogens; Mode of infection; Inoculum potential.

**CO3:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: Effect of environment on disease development- Predisposing factors; Survival of fungi; Germination of spores; Disease initiation and Epidemics; Host Parasites relationship - Mechanism and physiology of infection; Path of infection; Role of enzymes; growth regulators and toxins in pathogenesis; Physiological specialization : General account; Physiological specialization with special reference to smuts and rusts.

**CO4:-** The Third semester Botany students after the completion of this course will be able to understand and describe about: Recurrence of disease with special reference of recurrence of rust disease in India; Methods of Studying Plant Diseases: General account; Macroscopic study; Microscopic study; Koch postulates; Culture technique; Preparation of culture tubes; media preparation; Inoculation; Isolation; Pure culture; Parasitism of obligate parasites; Methods in bacteriology; Techniques required in introductory bacteriology.

## **MSc Botany Semester IV**

### **Paper-1: Plant reproduction and utilization of resources**

**CO1:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: Reproduction :Vegetative reparation; Methods of propagation; Pollination; Pollination- mechanism and vector; Structure of pistil; Pollen stigma interaction; Sporophytic and gametophytic Self-incompatibility (Cytological, biochemical and molecular aspects), Fertilization, double fertilization, in-vitro fertilization.

**CO2:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: Male gametophyte : Structure of anther; Microsporogenesis; Role of tapetum; pollen development; male sterility; sperm dimorphism and hybrid seed production; Pollen germination; Pollen tube growth and guidance; Pollen storage; Pollen allergy; Pollen embryo sac; Female gametophyte : Ovule development; Organization of embryo sac and Structure of embryo sac cells.

**CO3:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: Seed and Fruit development: Endosperm development during early; maturation and desiccation stages; Embryo genesis; Storage proteins of endosperm; Ultra structure and nuclear cytology; Cell lineage during late embryo development; Polyembryony; Apomixes;

Embryo culture; Endospermic and non-endospermic seeds; Dynamics of fruit growth; biochemistry and biology of fruit maturation.

**CO4:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: Utilization of resources: Plant used as avenue trees for shade; Pollution control and aesthetics; Innovation for meeting world food demands Origin of Agriculture; Green revolution; benefits and adverse consequences; Ethanobotanically important plants of Chhattisgarh; World centers of primary diversity of domesticated plants.

## **MSc Botany Semester IV**

### **Paper-2: Pollution and biodiversity conservation**

**CO1:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: CLIMATE; SOIL AND VEGETATION PATTERNS OF THE WORLD : Life zones; major biomes; major vegetation types and soil types of the world; barren land.

**CO2:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: POLLUTION, CLIMATE CHANGE AND ECOSYSTEMS : Air, water and soil pollution:- kinds, sources, quality parameters, effects on plants and ecosystem; Green house gases (Carbon dioxide, methane, nitrous oxide, Chloro fluorocarbons: sources, trends and role); ozone layer; ozone hole, consequences of climate change) Carbon dioxide fertilization; global warming; sea level rise, UV radiation).

**CO3:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: BIOLOGICAL DIVERSITY :- Concepts and levels; status in India; Utilization and concerns; role of biodiversity in ecosystem functions and stability; speciation and extinction; IUCN categories of threat; distribution and global patterns; terrestrial biodiversity hot spots; inventory; World centers of primary diversity of domesticated plants; The Indo Burmese center; plant introductions and secondary centers.

**CO4:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: CONSERVATION STRATEGIES Principles of conservation, extinctions; environmental status of plants based on International union for conservation of Nature; In situ conservation; International efforts and Indian initiatives; protected areas in India-sanctuaries; national parks, biosphere reserves; Wetlands; Mangroves and coral reefs for conservation of wild biodiversity; Ex situ conservation : Principles and practices; botanical gardens; field gene bank; seed banks; in vitro repositories; cryo banks; general account of the activities of Botanical survey of India (BSI); National Bureau of plant genetic resources (NBPGR);

Indian council of Agriculture research (ICAR); Council of scientific and Industrial research (CSIR); and the department of Biotechnology (DBT) for conservation and non formal conservation efforts.

## **MSc Botany Semester IV**

### **Paper-3: Plant cell, tissue culture and organ culture**

**CO1:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: **PLANTS CELLS AND TISSUE CULTURE:** General introduction, history, scope; concept of cellular differentiation; cellular totipotency; **TISSUE CULTURE MEDIA:** Introduction, Media constituents, Media selection, Media preparation; **CELL CULTURE:** Introduction isolation of single cells; Suspension cultures; Culture of Single cell; Plant cell reactors; Applications of cell culture; **CLONAL PROPAGATION -** Auxiliary bud proliferation; Meristem and shoot tip culture; bud culture; **ORGANOGENESIS AND ADVENTIVE EMBRYOGENESIS :** Fundamental aspects of morphogenesis; organogenesis via callus formation, direct adventitious organ formation.

**CO2:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: **SOMATIC EMBRYOGENESIS AND ANDROGENESIS :** Mechanisms, techniques and utility; **SOMATIC HYBRIDIZATION :** Methods of Protoplast isolation; Spontaneous and induced methods of protoplasm fusion; identification and selection of hybrid cells; Regeneration of hybrid plants; Verification and Characterization of somatic hybrids; Cybrids; possibilities; achievements and limitations of protoplast research.

**CO3:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: **CRYOPRESERVATION AND GERMPLASM STORAGE:** Raising sterile tissue cultures; Addition of cryoprotectants and pretreatment; freezing, storage; thawing; determination of survival viability; Plant growth and generation; verification; encapsulation and dehydration; Slow growth method; Applications; **INTELLECTUAL PROPERTY RIGHTS :** Possible ecological risks and ethical concerns.

**CO4:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: **APPLICATION OF PLANT TISSUE CULTURE :** Artificial seeds, Production of hybrids and soma clones; **PRODUCTION OF SECONDARY METABOLITES / NATURAL PRODUCTS :** Morphological and chemical differentiations; Medium composition for secondary product formation; Growth production patterns; Environmental factors; Selection of cell lines producing high amounts of a useful metabolite; Problems associated with secondary metabolite production Immobilized cell system; **TRANSGENICS IN CROP IMPROVEMENT:** Transgenic for Resistance to biotic and abiotic stresses; Transgenes for quality modification; Terminator seed technology; Chloroplast transformation and its utility.

## **MSc Botany Semester IV**

### **Paper-4: Elective paper-- molecular plant pathology**

**CO1:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: Epidemiology and disease forecasting: form of epidemics, factors responsible for the establishment of an epidemic, disease forecasting; General principles of plant disease control : General account; Prophylactic. Chemical (including fungicides, systemic fungicides, fumigants, antibiotics, growth regulators etc.) and biological control; Breeding for disease resistance varieties of host plants; Plant quarantine.

**CO2:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: Defense Mechanism- Defense of host against pathogen, Structural defense; Physiological defense, Biochemical defense-role of phenolic compounds; Phytoalexins Defense through hyper-sensitive reactions; Resistance and susceptibility: General account, types of resistance, vertical and horizontal resistance; breeding for disease resistance.

**CO3:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: Wilt disease: General account, symptoms of wilt disease, Mechanism of wilting; Diseases due to fungi: Rusts, smuts; Downy mildews powdery mildew diseases; Wilts; Leaf blight; Ergots; Tikka; necrosis; Rots-red rot of sugarcane; Damping off and warts diseases of economically important plants; Diseases due to Bacteria: Bacterial blight of Rice; Tundu disease; citrus canker; Crown galls of stone fruits; Angular leaf spots.

**CO4:-** The fourth semester Botany students after the completion of this course will be able to understand and describe about: Diseases due to Viruses: Mosaic of tobacco; Potato and tomato; Leaf curl of tomato & papaya; Yellow vein mosaic of Bhindi; Bunchy top of banana; Grassy shoot disease of sugarcane; Diseases due to Mycoplasma: Sandal spike; Little leaf of Brinjal; Grassy shoot disease; Sesamum; phyllody; Citrus greening; Diseases due to Nematodes: General characteristics of plants nematodes; Root knot; Malaya disease of Barley; wheat; Citrus nematodes; Ear cockle of wheat.

## **M.Sc. Chemistry**

## **Objective of the Programme**

The main objectives of the Chemistry Department are to prepare students for post graduate programme in specialized area of chemistry, and to prepare students for various jobs in industrial, government and related fields. They will be able to work as chemists, technicians in different laboratories and for research work.

The College follows Hemchand Yadav University, Durg Syllabus for M.Sc. Chemistry. The objectives of prescribed course are:

- Demonstrate an understanding of the principles of modern chemistry.
- Demonstrate a breadth and depth of knowledge in the discipline of chemistry.

### **M.Sc. (Chemistry)**

#### **Semester - First, Second, Third, fourth**

### **Programme Outcome**

- ★ Develop skills to learn modern concepts of chemistry.
- ★ Apply theory and practical knowledge to construct chemistry based solutions.
- ★ Design and develop new concepts in the areas related to organic, inorganic, physical spectroscopy, drug design etc.

### **Course Outcome**

After the completion of the course students will be able to:

- Master programme which aims to present a sound understanding of the modern principles of Chemistry.
- Students will understand the central role of chemistry in our society.

- Provide an exhaustive treatment of selected research-based topics, to significantly advance a student's career prospects in the industry, and equip the student to undertake research in chemistry.
- Provide theory, practical, and research paper courses.
- Advanced learners can pursue short term online certificate courses from SWAYAM, NPTEL based on their interest and latest career demands.

### **Programme Specific Outcome**

Programme of Master's in Chemistry is divided into four different semesters:-

#### **FIRST SEMESTER**

##### **Semester: I Semester**

Programme Specific Outcome

Paper No. - CH – 1, Course Title: - (Paper- I) Group Theory and Chemistry of Metal Complexes

Student will be able to-

- ❖ Understand the concepts of group theory.
- ❖ Use the imaginary axis and plane in group theory.
- ❖ Familiar with the molecular orbital theory and its applications.
- ❖ Understand the structures and properties of borides, carbides, nitrides, and silicides.
- ❖ Understand the concepts of metal – clusters.

##### **Semester: I Semester**

Programme Specific Outcome

Paper No. - CH – 2, Course Title: - Concepts in Organic Chemistry

Student will be able to-

- ❖ They will be able to learn about stereochemistry of organic compounds.
- ❖ Students will be able to develop an understanding about electronic structure, bonding, intermediates & elimination reaction mechanism.
- ❖ Students will have an idea about aromaticity and aromatic ring compounds.
- ❖ Students will have an idea about pericyclic reactions.

### **Semester: I Semester**

Programme Specific Outcome

Paper No. - CH - 3 Course Title: - Quantum Chemistry, Thermodynamics, and Chemical Dynamics  
- I

Student will be able to-

- ❖ Students will study about the chemical dynamics & catalysis.
- ❖ Students will be able to perform mathematical concept in quantum chemistry
- ❖ They will be able to learn about basic concepts of thermodynamics.
- ❖ Students will have an idea about electrochemistry.

### **Semester: I Semester**

Programme Specific Outcome

Paper No. - CH - 4 Course Title: - Theory and Applications of Spectroscopy- I

Student will be able to-

- ❖ This unit gives information about raman, electron diffraction spectroscopy and microwave spectroscopy.
- ❖ Student's gains knowledge of basic principles of spectroscopy.

### **M.Sc. (Chemistry) – I: Practical CH – 5 Laboratory Course - I**

**Scheme of Examination:-** Practical examination will be one experiment from each section is compulsory. Students will perform qualitative separation of acid and basic radicals, estimation and preparation of inorganic compounds. It will be of eight hours duration. The distribution of practical marks will be as follows:

Experiment 1 - 24

Experiment 2 - 20

Experiment 3 / Experiment 4 - 16

Viva - 20

Sessional - 20

Total - **100**

### **M.Sc. (Chemistry) - I: Practical CH – 6 Laboratory Course - II**

**Scheme of Examination:-** Practical examination will be one experiment from each section is compulsory. Students will perform adsorption/surface chemistry, phase equilibria, chemical



kinetics, conductometry, potentiometry/pH metry and polarimetry. It will be of eight hours duration. The distribution of practical marks will be as follows:

Experiment 1 - 30

Experiment 2 - 30

Viva - 20

Sessional - 20

Total - **100**

## **SECOND SEMESTER**

### **Semester: II Semester**

Programme Specific Outcome

Paper No. - CH - 7 Course Title: - Transition Metal Complexes

Student will be able to-

- ❖ In this unit various theories like VBT, CFT has been elaborated which is to co- ordination complexes and their spectral characteristics.
- ❖ Student will learn about electronic and magnetic properties of transition metal complexes.
- ❖ Deals with basic property like types, synthesis, stability etc. of alkyls and aryls of transition metal.
- ❖ Deals with carbon multiple bonds and fluxional organometallic compounds.

### **Semester: II Semester**

Programme Specific Outcome

Paper No. - CH - 8 Course Title: - Reaction Mechanisms

Student will be able to-

- ❖ Students will study about the aliphatic and aromatic nucleophilic substitution reactions.
- ❖ Deals with aliphatic and aromatic substitution reactions.
- ❖ This unit deals with addition to carbon – carbon multiple bonds abd carbon – hetero multiple bonds.

### **Semester: II Semester**

Programme Specific Outcome

Paper No. - CH – 9, Course Title: - Quantum Chemistry, Thermodynamics, and Chemical Dynamics - II

Student will be able to-

- ❖ This unit states with statics of thermodynamics and study of various models and concepts related to thermodynamics.
- ❖ Principles and theories which explain the electrochemistry and semiconductors.
- ❖ Principles and theories which explain the chemical dynamics.
- ❖ Students will know about the matrices and angular momentum of quantum chemistry.

### **Semester: II Semester**

Programme Specific Outcome

Paper No. - CH – 10, Course Title: - Theory and Applications of Spectroscopy - II

- ❖ Students gain the knowledge about UV, Visible, IR, Mass and NMR spectroscopy.
- ❖ Deals with basic principle, instrumentation and applications of above mentioned spectroscopy.

### **M.Sc. (Chemistry) – II: Practical CH – 11, Laboratory Course - III**

**Scheme of Examination:-** Practical examination will be one experiment from each section is compulsory. Students will understand separation and purification of organic compounds, analysis of organic binary mixture and preparation of organic compounds. It will be of eight hours duration. The distribution of practical marks will be as follows:

Experiment 1 - 10  
Experiment 2 - 30  
Experiment 3 - 20  
Viva - 20  
Sessional - 20  
Total - **100**

### **M.Sc. (Chemistry) – II: Practical CH – 12, Laboratory Course - IV**

**Scheme of Examination:-** Practical examination will be one experiment from each section is compulsory. Students will perform error analysis, computer programmes, flame photometry, nephelometry, electrophoresis and UV, Visible spectroscopy. It will be of eight hours duration. The distribution of practical marks will be as follows:

Experiment 1 - 10  
Experiment 2 - 25  
Experiment 3 - 25  
Viva - 20  
Sessional - 20  
Total - **100**

### **THIRD SEMESTER**

#### **Semester: III Semester**

Programme Specific Outcome

Paper No. - CH – 13, Course Title: - Resonance Spectroscopy, Photochemistry, and Organocatalysis

Student will be able to-

- ❖ Students gain the knowledge about ESR, NQR, PES, PAS spectroscopy.
- ❖ Deals with basic principle, instrumentation and applications of above mentioned spectroscopy.
- ❖ From this unit students gain the knowledge about photochemistry and miscellaneous photochemical reactions.
- ❖ Organocatalysis with principle and type has been also studied.

#### **Semester: III Semester**

Programme Specific Outcome

Paper No. - CH – 14, Course Title: - Chemistry of Biomolecules

Student will be able to-

- ❖ Students the knowledge of biomolecules and their important roles in chemistry and daily life.
- ❖ Students gain the knowledge of biopolymers, thermodynamics of biopolymers, cell membrane and transport of ions.
- ❖ This unit gives idea about the enzymes, co-enzyme chemistry, and biotechnological applications of enzymes.
- ❖ Students gain the knowledge about metalloenzymes and enzyme models.

#### **Semester: III Semester**

### Programme Specific Outcome

Paper No. - CH – 15, Course Title: - Catalysis, Solid State, and Surface Chemistry

Student will be able to-

- ❖ This unit deals with acids, bases, electrophiles nucleophiles and catalysis.
- ❖ Students gain the knowledge about micelles and adsorption.
- ❖ Students will have an insight view about classification, structures and applications solid state.
- ❖ This unit gives idea about definition, type, and various applications of macromolecules.

### **Semester: III Semester**

### Programme Specific Outcome

Paper No. - CH – 16, Course Title: - Analysis Techniques and Data Analysis

Student will be able to-

- ❖ Deals with basic sample preparation, digestion, and statistical analysis.
- ❖ Gain knowledge about TLC, HPLC, Column chromatography and Gas chromatography.
- ❖ Study about principle and instrumentation of TGA, DTA, and DSC.

### **M.Sc. (Chemistry) – III: Practical CH – 17, Laboratory Course - V**

**Scheme of Examination:-** Practical examination will be any two experiments is compulsory. It

will be of eight hours duration. The distribution of practical marks will be as follows:

Experiment 1 - 30

Experiment 2 - 30

Viva - 20

Sessional - 20

Total - **100**

### **M.Sc. (Chemistry) – III: Practical CH – 18, Laboratory Course - VI**

**Scheme of Examination:-** Practical examination will be any two experiments from each section is compulsory. Students will perform spectrophotometric determinations, polarography, pH metry, flame photometric determinations, refractometry, separation and quantitative estimation of binary and ternary mixtures by the using TLC, Paper chromatography, solvent extraction techniques. It will be of eight hours duration. The distribution of practical marks will be as follows:

Experiment 1 - 25

Experiment 2 - 25

Experiment 3 - 10

Viva - 20

Sessional - 20

Total - **100**

## **FOURTH SEMESTER**

### **Semester: IV Semester**

Programme Specific Outcome

Paper No. - CH – 19, Course Title: - Instrumental Methods of Analysis

Student will be able to-

- ❖ Students deals with advanced chromatography techniques like Ion chromatography, Size exclusion chromatography, SFC, Capillary Electrophoresis and Capillary Electrochromatography.
- ❖ Deals with basic principle, instrumentation and applications of X- ray, Proton Induced spectroscopy, Atomic Emission spectroscopy, and Atomic Absorption spectroscopy.

### **Semester: IV Semester**

Programme Specific Outcome

Paper No. - CH – 20, Course Title: - Natural Products and Medicinal Chemistry

Student will be able to-

- ❖ Student will learn about the classification, nomenclature, occurrence, isolation, and general methods of structure determination of terpenoids, carotenoids, and alkaloids.
- ❖ Study about isolation, structure determination and synthesis of steroids and plant pigments.
- ❖ Students deals with drug design and development.
- ❖ Various drugs like antineoplastic, antibiotics, antimalerials, and aminoquinoline drugs has been studied in detail which is useful in chemistry.

### **Semester: IV Semester**

Programme Specific Outcome

Paper No. - CH – 21, Course Title: - Material and Nuclear Chemistry

Student will be able to-

- ❖ This unit starts with non equilibrium thermodynamics.
- ❖ Students deal with material chemistry like synthesis, properties, characterization and application of nanoparticles.
- ❖ Gain knowledge about supramolecular chemistry.
- ❖ Student will learn about the nuclear and radiochemistry nuclear theory.

#### **Semester: IV Semester**

Programme Specific Outcome

Paper No. - CH – 22, Course Title: - Environmental and Applied Chemical Analysis

Student will be able to-

- ❖ This unit deals with air, soil, and water pollution.
- ❖ Study about food analysis and adulteration
- ❖ Students deal with cosmetics, clinical and drug analysis.

#### **M.Sc. (Chemistry) – IV: Practical CH – 23, Laboratory Course - VII**

**Scheme of Examination:-** Practical examination will be one experiment from each section is compulsory. Students will perform multistep synthesis of organic compounds, quantitative organic analysis, estimation of functional group, and extraction of organic compounds from natural sources. It will be of eight hours duration. The distribution of practical marks will be as follows:

Experiment 1 - 25  
 Experiment 2 – 20  
 Experiment 3 - 15  
 Viva - 20  
 Sessional - 20  
 Total - **100**

#### **M.Sc. (Chemistry) – IV: Practical CH – 24, Laboratory Course - VIII**

**Scheme of Examination:-** Practical examination will be one experiment from each section is compulsory. Students will perform spectroscopic determination, atomic absorption spectrophotometer, titrimetric/gravimetric determinations, chromatographic separation using paper chromatography and TLC techniques. It will be of eight hours duration. The distribution of practical marks will be as follows:

Experiment 1 - 25  
Experiment 2 - 25  
Experiment 3 - 10  
Viva - 20  
Sessional - 20  
Total - **100**





## **PGDCA**

### **PROGRAMME OUTCOME**

Students will be able to learn the latest trends in various subjects of computers & information technology. It will equip the students with skills required for designing, developing applications in Information Technology. The PG Diploma is aimed at graduates with a computing background and provides a detailed coverage of the key concepts and challenges in data and resource protection and computer software security. To give hands on to students while developing real life IT application as part of the study. To train graduate students in basic computer technology concepts and information technology applications. Design and develop applications to analyze and solve all computer science related problems.

### **PROGRAM SPECIFIC OUTCOME**

#### **PGDCA**

**PSO1:** To expose the students to open Source technologies so that they become familiar with it and can seek appropriate opportunity in trade and industry.

**PSO2:** Able to provide socially acceptable technical solutions to real world problems with the application of modern and appropriate programming techniques.

**PSO3:** Design applications for any desired needs with appropriate considerations for any specific need on societal and industrial aspects.

#### **PGDCA SEM-I**

##### **Course: C Programming**

##### **Objectives:**

1. To understand the program logic.
2. To implement the program.
3. To understand the derived and user-defined data types.

##### **Outcomes:**

CO1. Before implementation of any program, student has to learn about the program logic by using program development tools like algorithm, flowcharts and pseudo code. We taught students by taking real life examples about algorithm, flowcharts and pseudo code. Now our students have learnt how to develop the logic of the program.

CO2. Once the algorithm/ flowchart/pseudo code part is over, the student has to implement the program code by understand the defining of variables, data types, control statements like if, while, do-while, for, switch etc. statements. They have to also type & run the program on computer. Now all the students have learnt how to write and execute the program.

CO3. The students have to learn about efficiency of program by understanding derived data types (array, string, function, pointers) and user-defined data types (structure, union). Students were efficiently writing the programs using derived and user-defined data types to save program execution time and memory.

## **COURSE NAME : Computer Fundamentals**

### **Objectives:**

- 1] To learn fundamental concepts of computers
- 2] Acquired knowledge of input and output devices
- 3] To learn operating system, programming languages and basic terminology of networking
- 4] To learn binary, octal and hexadecimal number system and its conversion

### **Outcomes:**

CO1 : Bridge the fundamental concepts of computers with the present level of knowledge of the students

CO2 : Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming

CO3 : Familiarise operating systems, programming languages, peripheral devices, networking, multimedia and internet

CO4 : Understand binary ,octal and hexadecimal number systems and their arithmetic

CO5:- Students will be able to solve problems based on Proposition, Predicates and Logic. Logic topic will help them a lot in Digital Electronics which they will be learning in further semester.

CO6:- Students will be able to perform various operations based on Sets theory.

CO7:- To understand and solve the problems related to relations and functions.

CO8:- To Comprehend with Group, Lattices and its Properties.

CO9:- Students will be able to solve problems on graph theory .the Graph theory has application in various field of computer science like, Computer Graphics ,Data Structure, Artificial Intelligence etc. All these Topics will help the students to understand various important concepts of other subject of the course in higher studies.

### **Course Name: Office Automation**

#### **Course objective:**

1. To get familiar with basics of the Windows operating System
2. To learn Word Processing software such as Microsoft word
3. To learn MS Excel and its features
4. To learn MS Power point presentation

#### **Course Outcomes:**

CO 1. Students were able to understand working of windows operating system and got expertise in handling various windows operations & utilities

CO2.students were able to create effective & efficient word documents using various

Feature of word.

CO 3. Students were able to create different spreadsheet like mark list, attendance sheet, balance sheet, budget .also they were able to create various charts

CO 4. Students were able to create effective power point presentation with various design and animation effects.

## **PGDCA SEM-II**

### **COURSE NAME :Visual Basic Programming**

#### **Objectives:**

1. Acquired knowledge of programming skill, essential features and capabilities of Visual Basic Programming and Graphical user interface
- 2.To learn programming concepts, programming logic and event driven programming
- 3.To develop application using Visual Basic programming

#### **Outcomes:**

CO1: Students acquired the skills and knowledge required to use essential features and capabilities of Visual BASIC, a programming system used to produce Graphical User Interfaces and applications in a Windows environment.

CO2: Students studied basic programming concepts, problem solving, programming logic, and the design of event-driven programming.

CO3: Develop and debug applications using Visual Basic Programming that runs under Windows operating system.

### **COURSE NAME: DBMS**

#### **Objectives:**

The main objective of the course is to educate the students with fundamental concepts of DataBase management System, Data Models, Different data base languages, Relational Algebra and Normalization Techniques.

1. To build the strong foundation in database concept
2. Students will be able to learn the concept of View, Procedure, Cursor, Exception Handling, Functions, Triggers.

**Outcomes:**

Upon the successful completion of this course, Student will be able to

CO 1:- To analyze data base design methodology.

CO 2:- Acquire Knowledge in Fundamental of data base management system.

CO 3:- Analyze the difference between the traditional file system and DBMS.

CO 4:- Handle with different data base languages.

CO 5:- Draw various data model using ER modeling for real life applications along with that

they will be able to construct queries mathematically through relational algebra.

CO 6:- Understand the underlying concept of database technique.

CO 7:- Design and implementation of data base schema for a given problem domain.

CO 8:- Students will be able to handle with different database languages.

CO 9:- Students will be able to deal with Table, View, Procedures, Functions, Triggers.

CO 10:- Introduction to different database packages (Oracle/MYSQL/DB 2 etc).

CO 11:- Students will be able to use data base connectivity as front end.

CO 12. By the end Students will be able create projects.

**Course: E-commerce****Objective:**

- 1) To study the fundamental principles of e-commerce and e-business and the role of management.
- 2) To study relationship including Business to Consumer, Business to Business.
- 3) To study the technical foundation for understanding information system.
- 4) To study implement strategy in the new economy.

**Outcome:**

CO1 The students learned the impact of information and communication technology specially of the internet in business operation.

CO2 The students learned analyzing branding and pricing strategies and they also learned determining the effectiveness of market search. They also learned internet trading relationship including Business to Consumer, Business to Business and intra organizational.

CO3 The students learned how to be aware of the ethical, social and security issues of information system.

CO4 The students learned the insight on how to implement strategy in the new economy. Provide analytical tools to understand the opportunities in un-served and new economy market

## **M.Sc. (Computer Science)**

### **PROGRAMME OUTCOME**

The master of science in Computer Science Program provides the students with knowledge, general competence, and analytical skills on an advanced level, needed in academics, industry, research. Be technology-oriented with the knowledge and ability to develop creative solutions, and better understand the effects of future developments of computer systems and technology on people and society. Get some development experience within a specific field of Computer Science, through project work. Get ability to apply knowledge of Computer Science to the real-world issues. Be familiar with current research within various fields of Computer Science. Use creativity, critical thinking, analysis and research skill. Learn new technology, grasping the concepts and issues behind its use and the use of computers. Get prepared for placement by developing personality & soft skills. Communicate scientific information in a clear and concise manner. Build up programming, analytical and logical thinking abilities. Be able to understand the role of Computer Science in solving real time problems in society. Know the recent developments IT, future possibilities and limitations, and understand the value of lifelong learning. Get an ability to participate in debates, discussions in the society constructively.

### **PROGRAM SPECIFIC OUTCOME**

#### **MSc Computer Science**

**PSO1.** Communicate computer science concepts, designs, and solutions effectively and professionally

**PSO2.** Apply knowledge of computing to produce effective designs and solutions for specific problems

**PSO3.** Use software development tools, software systems, and modern computing platforms

## **M.Sc. Computer Science:- I Sem**

### **Course: Object Oriented Programming in C++**

#### **Objectives:**

1. To understand Object oriented programming feature.
2. To implement the program using OOP concept.
3. To understand the exception handling in OOP.

#### **Outcomes:**

CO1. C++ is superset of C language. It provides the data hiding feature. Students learned the difference between C and C++. They also learn the features of OOP like classes, objects, data abstraction & encapsulation, inheritance, polymorphism, message passing & dynamic binding etc.

CO2. Students learned about program writing using concept of OOP by taking the example of real life applications. They also learned how to protect data from outside world using different types of visibility labels and converting C programs into C++ program.

CO3. When the exception is raised, program is abnormally terminated. For handling such exceptions during the execution of program, students have learned exception handling model.

### **COURSE NAME : Linux Operating System**

#### **COURSE OBJECTIVE:**

1. To learn linux utilities, file processing operations, directory structure and security issues.
2. To learn how to use Linux operating system which help us in office work, technical and software development task
3. To learn Linux commands and shell script programs to solve problems.

#### **COURSE OUTCOME**

CO1: Students able to identified and used Linux utilities to create and manage simple file\ processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.

CO2: Students effectively used the Linux Operating system to accomplished typical personal, office, technical, and software development tasks.

CO3: Students able to choose appropriate Linux operating system commands to make effective use of the environment and write efficient, effective scripts with documentation to solve problems.

### **Course:Data Structures**



Throughout this course the students will try to learn:

**Course Objective:**

- 1) To study how the data is stored in computers memory for easy access.
- 2) To study the linear data structures.
- 3) To study the non-linear data structures.

**Course Outcome:**

CO1 The students learned about storing data in computers memory for getting efficient access for programs.

CO2 They learned and implemented the linear data structures such as linked list, stacks and queues. They handled the different operations on data structures such as insertion, deletion, searching, sorting and merging.

CO3 They learned and implemented the non-linear data structures such as trees and graph. Also they studied the practical applications of these data structures.

**Course name : Mathematical Foundation For Computer Science**

After completing this course, students will be able to:

- CO1. Comprehend and evaluate mathematical arguments revolving around computation.
- CO2. Understand the basics of Combinations and Permutations.
- CO3. Represent relations matrices and digraphs.
- CO4. Apply the knowledge on Graphs and Trees to real world applications.
- CO5. Demonstrate the working of Grammars and Languages.

**Course name : OPERATING SYSTEM**

## **Course Objective:**

The objective of the course is that the student will be able to know about

1. Basic concept and functions of modern operating system.
2. The concept of CPU Scheduling Algorithm.
3. What is deadlock and how to handle deadlock.
4. To learn the concept of I/O and file management.
5. To learn the concept of various memory management.
6. Students would learn the concept of security of operating system.

## **Course Outcome:-**

CO1. Describe the basic components of an operating system and their role in implementations for general purpose, real-time and embedded applications.

CO2. Define the concepts of processes, threads, asynchronous signals and competitive system resource allocation.

CO3 Explain what multi-tasking is and outline standard scheduling algorithms for Multi-tasking.

CO4. Discuss mutual exclusion principles and their use in concurrent programming including semaphore construction and resource allocation.

CO5. Expose the details of major operating system concepts, overview of system memory management and the implementation of file systems.

CO 6:- Fundamental understanding the role, function and services of operating system.

CO 7:- Students would have acquired the knowledge related to CPU scheduling algorithms.

CO 8:-Students would be able to categorized the difference between different process, thread and multi- Threading.

CO 9:-Students will gain the knowledge about the concepts of deadlock in operating system and how they  
Can be managed /avoided and implement them in multithreading system.

CO 10:- They will have the knowledge about the different types of I/O management, disk scheduling, and protection and security problems faced by operating systems and how to minimize these problems if occurred.

**Course name : COMPUTER SYSTEM ARCHITECTURE**

CO 1. Understand the theory and architecture of central processing unit.

CO 2. Analyze some of the design issues in terms of speed, technology, cost, performance.

CO 3. Design a simple CPU with applying the theory concepts.

CO 4. Use appropriate tools to design verify and test the CPU architecture.

CO 5. Learn the concepts of parallel processing, pipelining and interprocessor communication.

CO 6. Understand the architecture and functionality of central processing unit.

CO 7. Exemplify in a better way the I/O and memory organization.

CO 8. Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.

**M.Sc SEM.- II**

**Course:DBMS**

**Course Objective:**

The main objective of the course is to educate the students with fundamental concepts of Data Base management System, Data Models, Different data base languages, Relational Algebra and Normalization Techniques.

1. To build the strong foundation in database concept

2. Students will be able to learn the concept of View, Procedure, Cursor, Exception Handling, Functions, Triggers.

### **Course Outcome:-**

Upon the successful completion of this course, Student will be able to

CO 1:- To analyze data base design methodology.

CO 2:- Acquire Knowledge in Fundamental of data base management system.

CO 3:- Analyze the difference between the traditional file system and DBMS.

CO 4:- Handle with different data base languages.

CO 5:- Draw various data model using ER modeling for real life applications along with that they will be able to construct queries mathematically through relational algebra.

CO 6:- Understand the underlying concept of database technique.

CO 7:- Design and implementation of data base schema for a given problem domain.

CO 8:- Students will be able to handle with different database languages.

CO 9:- Students will be able to deal with Table, View, Procedures, Functions, Triggers.

CO 10:- Introduction to different database packages (Oracle/MYSQL/DB 2 etc).

CO 11:- Students will be able to use data base connectivity as front end.

CO 12. By the end Students will be able create projects.

### **COURSE NAME :Visual Basic Programming**

#### **COURSE OBJECTIVE :**

- 1] Acquired knowledge of programming skill, essential features and capabilities of Visual Basic Programming and Graphical user interface
- 2] To learn programming concepts, programming logic and event driven programming
- 3] To develop application using Visual Basic programming

#### **COURSE OUTCOMES:**

CO1 : Students acquired the skills and knowledge required to use essential features and capabilities of Visual BASIC, a programming system used to produce Graphical User Interfaces and applications in a Windows environment.

CO2 :Students studied basic programming concepts, problem solving, programming logic, and the design of event-driven programming.

CO3 :Develop and debug applications using Visual Basic Programming that runs under Windows operating system.

### **Course: Compiler Design**

Throughout this course the students will try to learn:

#### **Course Objective:**

- 1) To study about the compilers and other translators.
- 2) To study the different phases of compilation process.
- 3) To study the different parsing techniques.

#### **Course Outcome:**

CO1 The students learned about of the machine converts high level language into machine language for the successful execution of the program. They also studied the other translators such as assembler and interpreter.

CO2 They learned about the whole compilation process, all five phases of compiler in detail.

CO3 They studied about, how the expression is evaluated by the compiler using different parsing techniques.

### **M.Sc SEM.- III**

#### **Course name :IMAGE PROCESSING**

CO 1. Analyze general terminology of digital image processing.

CO 2. Examine various types of images, intensity transformations and spatial filtering.

CO 3. Develop Fourier transform for image processing in frequency domain.

CO 4. Evaluate the methodologies for image segmentation, restoration etc.

CO 5. Implement image process and analysis algorithms.

CO 6. Apply image processing algorithms in practical applications.

## **COURSE NAME: Computer Graphics**

### **Course Objective:**

Through this course student will try to learn:

1. To introduce the use of components of a graphics system and become familiar with building approach of graphic system components and algorithms related with them.
2. The basic principles of two dimension and three dimensional computer graphics.
3. To provide an understanding of how to scan convert the basic geometrical primitives, to transform the shapes, to fit them as per the picture definition.
4. Provide an understanding of mapping from world coordinate to device coordinates, clipping and projections.
5. To be able to discuss the applications of computer graphics concepts in the development of computer games, information visualization and business application.

### **Course Outcome:**

After the completion of the course the student must be able to:

CO1. List the basic concepts used in Computer Graphics.

CO2. To implement various algorithms, to scan convert the basic geometrical primitives, transformation,

Area filling and clipping.

CO3. To describe the importance of viewing and transformation.

CO4. To define fundamentals of animation.

CO5. To understand typical graphics pipeline.

## **M.Sc SEM.- IV**

### **Course name : MAJOR PROJECT**

After completing this course, students will be able to:

CO1. Identify, define and justify scope of the proposed problem

CO2. Gather and analyze system requirements

CO3. Propose an optimized solution among the existing solutions

CO4. Practice software analysis and design techniques

CO5. Develop a functional application based on the software design

CO6. Apply coding, debugging and testing tools to enhance the quality of the software

CO7. Construct new software system based on the theory and practice gained through this exercise

CO8. Prepare the proper documentation of software projects following the standard guidelines

CO9. Learn technical report and oral presentation skills

### **Course: Software Engineering**

Throughout this course the students will try to learn:

#### **Course Objective:**

- 1) To study different changing Nature of Software.
- 2) To study how to apply Software Engineering lifecycle.
- 3) To study the process assessment and personal and team process model.
- 4) To understand the concept of design pattern.
- 5) To be capable of applying his knowledge to create software architecture.
- 6) To study black box testing techniques.

- 7) To study the system, subsystem, SDLC, feasibility study and data collection techniques.
- 8) To study the tools and techniques of data analysis.
- 9) To study and understand the system testing and conversion methods.
- 10) To study different changing Nature of Software.
- 11) To study how to apply Software Engineering lifecycle.
- 12) To study the process assessment and personal and team process model.
- 13) To understand the concept of design pattern.
- 14) To be capable of applying his knowledge to create software architecture.
- 15) To study black box testing techniques.
- 16) To study the Role of Process in Software Quality and testing as a Process.
- 17) To study Origin of Defects? How to calculate the cost of Defect ?
- 18) To study different Defect Prevention Strategies methods.
- 19) To study Need of Level of Testing.
- 20) To study the Role of Three Group in Testing and Policy Development.

**Course Outcome:**

CO1 The students learned the ability to work Significantly in all application domain from System Software to Embedded software to Artificial Intelligence and Robotics.

CO2 They learned how to apply the software engineering lifecycle by Demonstrating the use of requirement analysis from Communication, Planning, Analysis design, Construction and Deployment.

CO3 They learned to demonstrate and ability to use the techniques tools necessities for engineering practice and to work as an individual and as a part of multidisciplinary team to deliver quality software.

CO4 They identified the appropriate design pattern to solve object oriented design



problem and construct design solution by using behavioral patterns.

CO5 The students learned to Understand the software architecture and build the system from the component.

CO6 The students learned to test the software without the knowledge of internal structure of program or application.

CO7 The students learned about testing as a Process how it can be classified into Verification and Validation testing Process. They also learned and understand the different aspects of testing process the Technical Aspect, Managerial Aspect and Economic aspect of testing Process.

CO8 The students studied the factors which causes the Defects to enter in software . The Impact the Defect have on Software Artifacts. And the Impact of Defect from users point of view. The students also learned how to calculate the real life Cost of the Defect in the Software Project.

CO9 They learned the different Methods Such as Pareto Analysis and Fishbone Analysis and how it can be used in software and defect prevention techniques such as Review and Inspection , Walkthroughs Defect logging and Documentation.

CO10 The students studied all the levels in testing Unit Testing , Integration testing ,System Testing and Acceptance testing. They learned how to Design and Plan each of this test and record there results in Test Logs.

CO11 The students studied the Role of Managers , Developers / Tester and User Client in Software Development .

CO12 The students learned about the system, the steps for building the system, the economic, technical and operational feasibility of the system. They learned and understands the different data collections methods for the system such as interviews, questionnaires and onsite observation.

CO13 The students studied the Data Flow Diagram and the other tools required to design

the system.

CO14 The implemented system tested using different testing methods, such as unit testing, integration testing, white box testing, black box testing etc.

CO15 The students learned the ability to work significantly in all application domain from System Software to Embedded software to Artificial Intelligence and Robotics.

CO16 They learned how to apply the software engineering lifecycle by demonstrating the use of requirement analysis from Communication, Planning, Analysis design, Construction and Deployment.

CO17 They learned to demonstrate and ability to use the techniques tools necessary for engineering practice and to work as an individual and as a part of multidisciplinary team to deliver quality software.

CO18 They identified the appropriate design pattern to solve object oriented design problem and construct design solution by using behavioral patterns.

CO19 The students learned to understand the software architecture and build the system from the component.

CO20 The students learned to test the software without the knowledge of internal structure of program or application.

### **Course Name: Artificial Intelligence**

CO1: Solve basic AI based problems.

CO2: Define the concept of Artificial Intelligence.

CO3: Apply AI techniques to real-world problems to develop intelligent systems.

CO4: Select appropriately from a range of techniques when implementing intelligent systems

### **Course Name: DATA MINING**

CO 1: Evaluate and implement a wide range of emerging and newly-adopted methodologies and technologies to facilitate the knowledge discovery. •

CO 2: Assess raw input data, and process it to provide suitable input for a range of data mining algorithms. •

CO 3: Discover and measure interesting patterns from different kinds of databases •

CO 4: Characterize and discriminate data summarization forms and determine data mining functionalities.

CO6. Evaluate and select appropriate data-mining algorithms and apply, and interpret and report the output appropriately. •

CO 6: Design and implement of a data-mining application using sample, realistic data sets and modern tools.

## **M.Sc. Physics**

### **PROGRAM SPECIFIC OUTCOME OF M.Sc.**

The theory of Classical Mechanics (is a branch of Physics) accurately describes the motion of objects, provided they are much larger than atoms and moving at much less than the speed of light. These theories continue to be areas of active research today. Solid State Physics develop a basis for future learning and work experience. Nuclear physics develop familiarity with nuclear and particle physics , facilitating informed decisions as students pursue research projects, internships, careers and graduate study. Quantum mechanics develop problem solving methods that will include mathematical as well as numerical computations and solutions. Material science is a very wide branch where extensive research is going on. Thermal, electrical, optical and magnetic properties of matter provide a strong foundation in that direction. Thermal and Statistical physics explore various applications related to topics in material science and the

physics of condensed matter. The course of Electronics will make the students to identify the electronic components and their working principles.

## **M.Sc. SEMESTER –I**

### **Paper 1- Mathematical Physics**

**CO(1):** Students would learn mathematical methods to solve the various problems in Physics.

**CO(2):** Students understand the concepts of vector and matrices.

**CO(3):** They are able to solve the problems of Fourier Transforms and special functions.

**CO(4):** Students understand the concept of differential equations.

**CO(5):** Students understand complex analysis and variables.

### **Paper 2- Classical Physics**

**CO(1):** Students understand Newton's law of motion and their applications such as projectile and rocket.

**CO(2):** Classify elastic and inelastic scattering.

**CO(3):** understand Lagrangian and Hamiltonian formula.

**CO(4):** Gain the knowledge of motion in central force field.

**CO(5):** solve the problems using Lagrangian and Hamiltonian equations.

### **Paper 3- Electrodynamics and Plasma Physics**

**CO(1):** Students have gained a clear understanding of Maxwell's equations and electromagnetic boundary conditions.

**CO(2):** Students understand Lienard- Wiechart potential and field for a point charge.

**CO(3):** Students understand the basic concept of Cyclotron and Synchrotron Emission and Cherenkov radiation.

**CO(4):** Students understand physical phenomenon in plasma.

**CO(5):** Students understand the concept of MHD equations, Magneto-sonic waves and Alfen waves.

#### **Paper 4- Electronics**

**CO(1):** Students understand Field Effect Transistor, their principles and applications.

**CO(2):** Students understand devices like RTL, TTL, DTCL.

**CO(3):** They are able to understand various Logical Families, Flip-Flop, ALU Memories.

**CO(4):** They understand concept of Microprocessor.

**CO(5):** Students are able to create programme of summing of 8-bit numbers to result 16-bit numbers.

#### **COURSE OUTCOME OF M.Sc. SEMESTER- II**

##### **PAPER-I (QUANTUM MECHANICS)**

**CO:1** Students articulate the experience and understand the inadequacies of classical mechanics. Introduction to quantum mechanics and different aspects of Schrodinger's Equation.

**CO:2** Develop understanding about the Super position Principle- its general formalism, representation of states and dynamical variables. Harmonic Oscillator and its solution by Matrix method.

**CO:3** Students acquire the knowledge about Angular Momentum in Quantum mechanics, Clebsch – Gordan Coefficients.

**CO:4** Students get well versed with central force problem, spherically symmetric potentials in 3 D. The hydrogen atom- its solution in radial energy levels and stationary state wave function.

**CO:5** Develop understanding of time- independent perturbation theory, non- degenerate case, first order and second order Zeeman Effect, Stark Effect in Hydrogen atom.

##### **PAPER-II ( STATISTICAL MECHANICS)**

**CO:1** Students get an overview of – formation of statistical mechanics:- microscopic and macroscopic states. The classical gas, entropy of mixing, Gibb's paradox, Liouville's Theorem.

**CO:2** Students develop understanding for elements of ensemble theory- partition function. Physical significance of statistical quantities, mutual correspondence of various ensembles.

**CO:3** Students articulate about formation of quantum statistics, Quantum mechanical ensemble theory. Theory of simple gases- Maxwell- Boltzmann, Bose- Einstein, Fermi- Dirac distributions and the statistics of occupation number.

**CO:4** Understanding about Ideal Bose and Fermi gases- its thermodynamic behavior. Relativistic and non- relativistic degenerate electron gas, theory of white dwarf stars.

**CO:5** Understanding of Statistical mechanics of interacting systems. Spatial co-relation in a fluid Brownian motion

### **PAPER –III ELECTRONIC AND PHOTONIC DEVICES AND OPTICAL MODULATORS**

**CO:1** Students develop understanding about special bipolar devices-eg. Thyristors, the basic characteristics about four layer diodes- DIAC & TRIAC.

**CO:2** Students acquire the knowledge about- Unipolar devices like JFET, MOSFET & MESFET- their basic structure, working & I-V characteristics. Introduction to MIS & MOS diodes as well charge –coupled devices (CCDs).

**CO:3** Students get an overall view about- Special Microwave Devices- tunnel Diode and Backward Diode- Basic Device. IMPATT DIODE- basic and static characteristics, Gunn diode.

**CO:4** Students become aware of Photonic devices: Radiative transitions, LEDs and experience different aspects of visible and infrared semiconductor lasers. P-N junction solar cells, solar radiation and ideal conversion efficiency which leads to the development of thin films.

**CO:5** Students develop understanding about Optical Modulators and Display Devices- Modulation of light- Birefringence. Display Devices: Luminescence, Photoluminescence, Electro- Luminescence, Liquid Crystal Displays.

### **PAPER-IV COMPUTATIONAL METHODS & PROGRAMMING**

**CO:1** Students develop understanding of methods of determination of zeroes of linear and non-linear algebraic equations. Solution of simultaneous linear equations- Gaussian elimination, Matrix Inversion.

**CO:2** Understanding of finite differences, inter- polation with equally spaced and unevenly spaced points. Numerical differentiation and integration- Newton- Coles Formula.

**CO:3** Students become aware of numerical solution of ordinary differential equation. Euler and Runge- Kutta Methods, elementary ideas of solutions of partial differential equations.

**CO:4** Students get to know about digital computer principles, Computer principles, Compilers, Fortran programming, flowcharts, integers built-in functions.

**Co:5** Students develop knowledge of executable and non- executable statements, assignments, control and input-output statements subroutines and functions. FORTRAN programming- external statement, subroutine, subprogram, formal statements and field specifications.

### **Course Outcome of MSc SEMESTER - III**

#### **Paper 1- Quantum Mechanics**

Students will be able to:-

**CO:1** Understand variational method, expectation value of energy, WKB approximation, energy levels of potential well and quantization rules.

**CO:2** Learn and understand the theory of differential and total scattering. The Born approximation, Partial wave analysis, scattering by square well and Coulomb potential.

**CO:3** Analyze Time dependent perturbation theory, Fermi's golden rule, Identical particles, symmetric and anti-symmetric wave function.

**CO:4** Understand relativistic quantum mechanics Klein Gordan equation and Dirac equation.

**CO:5** Learn spin of Dirac particle, spin angular momentum, spin orbit energy.

#### **PAPER-II ATOMIC AND MOLECULAR PHYSICS**

Students will be able to-

**CO1:** Understand Quantum states of one  $e^-$  atoms, fine structure of H- spectrum with l-s interaction and relativistic correction.

**CO2:** Analyse Pauli's principle, equivalent non-equivalent  $e^-$ s, L-S & J-J coupling, hyperfine structure.

**CO3:** Learn Zeeman effect, Paschen Back effect and Stark effect.

**CO4:** Learn & understand types of molecules, rotational spectra, Raman spectrum.

**CO5:** Understand Vibrational spectra, rotational vibrational spectrum, Raman spectrum.

### **PAPER-III: SOLID STATE PHYSICS**

Students will be able to-

**CO1:** Learn nearly free  $e^-$  model, Bloch theorem, Kronig Penny model & periodic potential.

**CO2:** Understand Zone schemes, able to construct Fermi surface and calculate energy bands. Experimental methods in Fermi surface studies.

**CO3:** Analyse crystal vibration, phonons, thermal properties of phonons.

**CO4:** Learn and understand superconductivity using experimental and theoretical methods.

**CO5:** Learn semiconductor crystals, band gap, equation of motion, intrinsic carrier concentration, impurity conductivity.

### **PAPER- IV: ELECTRONICS (COMMUNICATION)**

Students will be able to-

**CO1:** Learn microwave devices like klystron, magnetron, TWT with principle of operation.

**CO2:** Understand microwave guides & components.

**CO3:** Analyse microwave cavities & TED<sub>s</sub> like Gunn Diode, Impatt diode, Trapatt diode etc.

**CO4:** Learn and understand Radar system, its block diagram, operation, radar frequencies, pulse consideration, radar range equation, antenna, radar transmitter, receivers, antennas display.

**CO5:** Learn satellite communication, orbital satellite, geostationary satellite, orbital pattern, look angles, orbital spacing, satellite system, link modules.

### **Course Outcome of MSc SEMESTER – IV**

#### **(PAPER 1)- NUCLEAR AND PARTICLE PHYSICS**

**CO:1** Students articulate the following- Experience and understand the basics of Nuclear interactions, scattering length and Effective Range Theory. Introduction to charge independence and charge symmetry of nuclear forces, exchange forces and Yukawa interaction.



**CO:2** Students develop and understand- Reaction energetic: Q-equations and threshold energies. Formal reaction theory: Partial wave approach and phase shifts, scattering matrix, Reciprocity theorem.

**CO:3** Students acquire the knowledge about- Nuclear decay with detection and properties of neutrino. Gamma decay and its multiple transition in nuclei. Parity selection rules, internal conversion and nuclear isomerism.

**CO:4** Students get well versed with- The difference type of Nuclear Models. Analysis of shell model prediction magnetic moments and Schmidt lines, collective Models of Bohr and Mottelson.

**CO:5** Students become aware of- Elementary particle Physics, developing the knowledge about the fundamentals interactions, its classification and properties of Quarks, the standard model.

## **PAPER-2 LASER PHYSICS AND APPLICATIONS**

**CO(1):** Students get an overview of-The different characteristics of LASER emission, absorption, optical processes. The basic principle of LASER- population inversion, laser pumping, threshold condition and quantum yield.

**CO(2):** Students articulate-The solid state laser- Nd: YAG Laser, Nd: Glass laser, the Ruby laser. The different laser systems- chemical laser, liquid lasers, gas lasers and dye lasers.

**CO(3):** Students develop understanding about different advances in laser physics, the parametric generation and self- focusing of light.

**CO(4):** Students acquire the knowledge about-Multi photon process like theory of two-photon process, parametric generation of light .Laser- spectroscopy – Rayleigh and Raman Scattering, Photon-acoustic Raman Spectroscopy.

**CO(5):** Students develop the understanding of different applications of Laser and the communication by Laser, pulse dispersion.

## **PAPER- III SOLID STATE PHYSICS -II**

**CO:1** Students develop understanding about the dielectric function of electron gas, dispersion relation for EM wave, Electrostatic screening and screened coulomb potential.

**CO:2** Students acquire the knowledge about Maxwell's equation, Polarization, Macroscopic electric field, depolarization field, Landau theory of phase transitions, first & second order transitions, Ferro- elasticity, optical ceramics.

**CO:3** Students get an over-view about -General ideas of Para magnetism, quantum theory of Para magnetism, rare earth ions. Cooling by isentropic demagnetization, nuclear demagnetization, paramagnetic susceptibility of conduction electrons.

**CO:4** Students become aware of –Ferromagnetic order, temperature dependence of saturation magnetization at absolute zero, magnons and quantization of spin waves. Ferrimagnetic order: Curie temperature and susceptibility of ferrimagnets, iron garnets.

**CO: 5** Students develop the understanding about-Optical reflectance, excitations – Frenkel and Mott –Warnier Excitations, Alkali Halides and Molecular crystal Defects: Lattice vacancies. Line Defects- shear strength of single crystals, dislocations- edge and screw dislocations, strength of alloys, dislocations and crystal growth, hardness of materials.

#### **PAPER –IV ELECTRONICS II (COMMUNICATION)**

**CO:1** Students develop understanding of Digital communication- Pulse modulation systems, sampling theorem, Quantization of signals, quantization error.

**CO:2** Students articulate the following - Digital Modulation Techniques - PCM, BPSK, DPSK, QPSK, PSK, QASK, BFSK, FSK and MSK.

**CO:3** Students become aware of- Mathematical representation of noise- sources of noise, frequency domain representation of noise, the probability of Gaussian noise. Binear filtering, Noise band width with Quadrature component of noise, Power spectral density and their derivatives.

**CO:4** Students get toknow about-Base band signal receiver, probability of optimum filter, white noise.Calculation of error, probability for BPSK, BSFK and QPSK.

**CO:5** Students develop the knowledge about the data transmission for Noise in pulse code & delta modulation system, PCM transmission, calculation of Quantization noise output signal power.

#### **PROGRAMME OUTCOME OF M.Sc. PHYSICS**

**PO:1** The Master of Science in physics program provides the candidate with knowledge, general competence and analytical skills on an advanced level, needed in industry, consultancy, education and research.

**PO:2** On completion of program, the post graduates will apply the knowledge and skill in the design and development of electronic circuits to fulfill the needs of electronic industry.

**PO:3** Become professionally trained in the area of electronics , optical communication, non-linear circuits, materials characterization and lasers. Pursue research related to Physics and Materials characterization.

**PO:4** Demonstrate highest standards of Actuarial ethical conduct and Professional Actuarial Behavior, critical, interpersonal and communication skills as well as commitment to life- long learning.

## M.Sc. Mathematics

### Department of Mathematics Master of Science (Mathematics)

**OBJECTIVES OF THE PROGRAMME:** The college follows Hemchand Yadav University, Durg syllabus for M.Sc. course. The objectives of the prescribed course are: Mastery of the Knowledge- In their fields and the ability to apply their expertise to novel and emerging problems. Effective researches Able to state a research problem, apply research methods, tools for data collection, analyze and interpret research data. Demonstrate critical thinking Apply analytical models and critical, reasoning propellers to calculate evidence, select among alternatives and generate creative options. Possess effective communication skills Student can communicate their research clearly and professionally in both written and oral forms appropriate to the field through publications, conference papers, seminars etc. Demonstrate teamwork and leadership skill Specifically function in a variety of work groups. COURSE OUTCOME On completion of this course, the students will be able to:-

- Identify the concept of Normal groups and Quotients groups.
  - Concentrate on a particular Euclidean ring and other forms of Polynomial rings.
  - Study in detail the Mean value theorem and Taylor's theorem.
  - Locate Sequence and Series comprising convergence sequences, upper and lower limits
- Understand Local properties of Analytic functions.
- Analyze Analytic functions and exponential functions
  - . • Discuss and understand the importance of the concepts Graph and Lattice, Algebraic Structure
  - . • Study the properties of trees and connectivity.
  - Understand the elements of Galois Theory.
  - Discuss connected spaces, the components of a space and totally disconnected spaces.
  - Study Continuous linear transformations and the Hahn-Banach theorem
  - . • Understand the Open Mapping Theorem and its applications
  - . • Apply Duality to solve problems in Linear Programming.
  - Study Assignment Problem and its applications.

## **M.Sc.(Maths)– 4 Semesters**

Postgraduate programme Programme Outcomes (PO), Programme Specific Outcomes (PSO), Course Outcomes (CO) Class Paper Name Outcome M.Sc.- I & II Sem. Advanced Abstract Algebra.

1. Students will learn Group theory, Ideals, Ring theory, Modules, Vector space, Normal Group, Abelian group etc.
2. Students Skills to solve any theorem by using the properties of the given group, Ring, Ideal or field.
3. Students compute different theorems and learn how to find the Galois group of any given group. Real Analysis Students will be able to know the sequence and series of real numbers, convergence and divergence of both sequence and series. Determine the Riemann integrability.

Topology Students Skill to:-

1. Understand various basic topologies and topological spaces.
2. Understand the countability and uncountability of spaces and sets and their types.
3. Understand the concept of connectedness, compactness, completeness of spaces.
4. Understand the topological and hereditary property
5. Learns the separation axioms.

Complex Analysis Students will learn to:-

1. Analyze sequence and series of complex numbers and analytical function.
2. Apply the concept of Cauchy-Riemann equations for analytic function.
3. Compute complex contour integrals and apply the cauchy Integral formula in various versions.
4. Understand the concept of Harmonic functions.

Advanced Discrete Mathematics

1. Students will know about the finite state machine, their outputs corresponding to their next state of input.
2. Students will learn the conjunctives and disjunctive Canonical form of two, three, four variables.
3. Students learn to formulate the output of Mealy and Moore machine, parallel and series circuits.
4. Students will have the knowledge of graphs, Trees, Spanning trees etc.

### **M.Sc.- III & IV Sem.**

Integration Theory and Functional Analysis Students Skill to:-

1. Learn the concept of linear and bounded linear transformation.
2. Understands the Function spaces and conjugate of Function Spaces.
3. Understand the concept of Dual linear spaces.
4. Learns to compute the real and complex functions.

PDE and Mechanics Students will have the knowledge and Skills to:-

1. Form the partial differential equations and solve them.
2. Learn the wave equations and heat equations and form their solutions.
3. Solve the problems on first order and higher degree partial differential equations and its application.

Operations Research

1. Students will be able to model LPP and solve them.
2. Students will understand the feasibility, infeasibility, basic, bounded, unbounded, optimal solutions of the problem.
3. Students will understand the Game theory.

### **M.Sc. (MATHEMATICS)**

#### **Semester-I**

There shall be five papers. Each paper shall have 100 marks. Overall tally of marks will be 500.

Papers	Description	Theory	Sessional	Total Marks
I	Advanced Abstract Algebra	80	20	100
II	Real Analysis (I)	80	20	100
III	Topology	80	20	100
IV	Advanced Complex Analysis (I)	80	20	100
V	Advanced Discrete Mathematics (I)	80	20	100

#### **Semester-II**

There shall be five papers. Each paper shall have 100 marks. Overall tally of marks will be 500.

Papers	Description	Theory	Sessional	Practical	Total Marks
I	Advanced Abstract Algebra	80	20		100
II	Real Analysis (II)	80	20		100
III	General and Algebraic Topology	80	20		100
IV	Advanced Complex Analysis (II)	80	20		100
V	Advanced Discrete Mathematics (II)	80	20		100

### **Semester-III**

There shall be five papers. Each paper shall have 100 marks. Overall tally of marks will be 500. Papers Description Theory Sessional Practical Total Marks I Integration Theory and Functional Analysis (I) 80 20 -- 100 II Partial Differential Equations & Mechanics (I) 80 20 -- 100 III General Relativity and Cosmology (I) 80 20 -- 100 IV Operations Research (I) 80 20 -- 100 V Graph Theory (I) 80 20 – 100.

### **Semester-IV**

There shall be five papers. Each paper shall have 100 marks. Overall tally of marks will be 500. Papers Description Theory Sessional Practical Total Marks I Integration Theory and Functional Analysis (I) 80 20 - 100 II Partial Differential Equations & Mechanics (I) 80 20 - 100 III General Relativity and Cosmology (I) 80 20 - 100 IV Operations Research (I) 80 20 – 100 V Graph Theory (I) 80 20 – 100.

**PROGRAMME OUTCOME** On completion of the programme, the student will be able to:-

- Investigate and solve unfamiliar math problem.
- Develop the Knowledge of create Mathematical models to solve real world problem.
- Apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry, and illustrate these solutions using symbolic, numeric, or graphical methods.
- Demonstrate basic manipulative skills in algebra, operation Research, real analysis and functional analysis.
- Develop mathematical skill to solve problems

**PROGRAMME SPECIFIC OUTCOMES** The course of M.Sc.(Mathematics) Semester-I has been divided into five papers:

#### **PSO-01: Advanced Abstract Algebra (I)**

- Gain Knowledge in Groups - Normal and Subnormal series.

- Study about Field theory- Extension fields, Algebraic and transcendental extensions
- Gain Knowledge about Perfect fields, Finite fields and algebraically closed fields.
- Study about Automorphism of extensions and Galois extensions.
- Solve polynomial equations by radicals and Insolvability of the general equation of degree 5 by radicals.

### **PSO-02: Real Analysis (I)**

- Gain knowledge regarding Sequences and series and uniform convergence.
- Study the uniqueness theorem for power series, Abel's and Tauber's theorems
- Solve functions of several variables and linear transformations.
- Learn the concept Jacobians, extremum problems with constraints and Lagrange's multiplier method.
- Solve Partitions of unity, Differential forms and Stoke's theorem.

### **PSO-03: Topology (I)**

- Understand Bases and sub-bases, Subspaces and relative topology.
- Gains knowledge regarding First and Second Countable spaces.
- Study Separation axiom their Characterizations and basic properties.
- Gain knowledge in the concept of Local compactness and one point compactification.
- Study Compactness in metric spaces and Equivalence of compactness.

### **PSO-04: Complex Analysis (I)**

- Understand Complex integration, Cauchy-Goursat and Higher order derivatives, Morera's Theorem
- Learns about the Maximum modulus principle, Schwarz lemma and the argument principle, Rouché's theorem Inverse function theorem.



- Study will be Cauchy's residue theorem, Evaluation of integrals and branches of many valued functions.
- Knowledge gain about the bilinear transformations, their properties and classifications, Definitions and examples of conformal mappings
- Solve Spaces of analytic functions, Hurwitz's theorem and Montel's theorem Riemann mapping theorem.

### **PSO-05: Advanced Discrete Mathematics (I)**

- Students about the concept of Formal Logic-Statements and Symbolic Representation and Tautologies.
- Gains knowledge in the concepts of Homomorphism of semigroups and monoids, Congruence relation and Quotient Semigroups.
- Identify types of Lattices-Lattices as partially ordered sets, their properties, Lattices as Algebraic Systems, Sublattices, Direct products, and Homomorphisms.
- Solve Applications of Boolean Algebra to Switching Theory (using AND, OR and NOT gates) and The Karnaugh Map Method.
- Learns about the Grammars and Languages-Phrase-Structure Grammars and Rewriting Rules, Derivations, Sentential Forms, Language generated by a Grammar.

The course of M.Sc. (Mathematics) Semester-II has been divided into five papers:

### **PSO-06: Advanced Abstract Algebra (II)**

- Gain knowledge Modules - Cyclic modules, Simple modules, Semi-simple modules and Schuler's Lemma.
- Study about the concept of Linear Transformations - Algebra of linear transformation.
- Learns the Canonical Forms - Similarity of linear transformations and Invariant subspaces.
- Understand Fundamental structure theorem for finitely generated modules over a Principal ideal domain.
- Study about the concept Rational canonical form and generalised Jordan form over any field.

### **PSO-07: Real Analysis**

(II) • Learns about the definition and existence of Riemann-Stieltjes integral and Properties of the Integral.

- Learns about the Lebesgue outer measure.
- Solve uniqueness of Extension, Integration with respect to a measure, Riemann and Lebesgue Integrals
- Solve the four derivatives, Lebesgue Differentiation Theorem and Differentiation and Integration.
- Study the Functions of Bounded variation. The  $L^p$ -spaces. Convex functions

### **PSO-08: General and Algebraic Topology (II)**

- Study the Tychonoff product topology in terms of standard sub-base and its characterization
- Gain Knowledge Product spaces, Connectedness and product spaces.
- Study about the Embedding and metrization, The Nagata-Smirnov metrization theorem.
- Identify types of Nets and filter. Topology and convergence of nets. Hausdorffness and nets
- Learns the concept of the fundamental group and covering spaces-Homotopy of paths.

### **PSO-09: Advanced Complex Analysis (II)**

- Study about the Weierstrass' factorisation theorem, Gamma function and its properties and Riemann Zeta function.
- Learns the methods and properties analytic Continuation, Uniqueness of direct analytic continuation and Uniqueness of analytic continuation along a curve.
- Solve Harmonic functions on a disk, Harnack's inequality and theorem and Dirichlet Problem.
- Learns the concept of Canonical products, Jensen's formula and Poisson-Jensen formula.
- Student will be the range of an analytic function, Bloch's theorem and The Little Picard theorem.

### **PSO-10: Advanced Discrete Mathematics (II)**

- Gain knowledge Graph Theory-Definition of (Undirected) Graphs, Paths, Circuits, Cycles, and Subgraphs and Induced Subgraphs.
- Verify the Spanning Trees, Cut-sets, Fundamental Cut -sets, Cycle. Minimal Spanning Trees and Kruskal's Algorithm.
- Solve directed Graphs, In degree and Out degree of a Vertex, Weighted undirected Graphs and Dijkstra's Traversals.
- Understand Introductory Computability Theory-Finite State Machines and their Transition Table Diagrams
- Able to solve finite Automata, Acceptors, Non-deterministic Finite Automata and equivalence of its power to that of Deterministic Finite Automata.

The course of M.Sc. (Mathematics) Semester-III has been divided into five papers

#### **PSO-11: Integration Theory and Functional Analysis (I)**

- Solve Signed measure, Hahn decomposition theorem, mutually singular measures. Radon-Nikodym theorem.
- Study about the Lebesgue-Stieltjes integral, product measures, Fubini's theorem, Differentiation and Integration.
- Identify types of Baire sets, Baire measure, continuous functions with compact support.
- Learns the method Riesz Lemma, basic properties of finite dimensional normed linear spaces and compactness.
- Gain knowledge normed linear spaces of bounded linear transformations, dual spaces with examples.

#### **PSO-12: Partial Differential Equations and Mechanics**

- Study about the concept of Mean Value Formulas, Properties of Harmonic Functions, Green's Function, energy Methods.
- Gain knowledge Heat Equation-Fundamental Solution, Mean Value Formula, Properties of Solutions and Energy Methods.
- Solve Energy equation for conservative fields and Hamilton's variables.
- Solve Poisson's Bracket, Poisson's Identity and Jacobi-Poisson Theorem.

- Solve Laplace and Poisson equations, Work done by self attracting systems.

### **PSO-13: General Relativity and Cosmology (I)**

- Understand General Relativity-Transformation of coordinates and Tensors, Algebra of Tensors
- Solve Riemann Christoffel curvature tensor and its symmetry properties, Bianchi identities and Einstein tensor.
- Study about Einstein's field equations and its Newtonian approximation. • Gain knowledge advance of perihelion of a planet, bending of light rays in a gravitational field.
- Learns the concept of Energy-momentum tensor of a perfect fluid. Schwarzschild internal solution.

### **PSO-14: Operations Research (I)**

- Gain knowledge in advance Operations Research and its Scope, Necessity of Operations Research in Industry and Linear Programming-Simplex Method.
- Solve Other Algorithms for Linear Programming-Dual Simplex Method.
- Students will be familiar with the techniques Parametric Linear Programming.
- Solve Transportation and Assignment Problems.
- Study about the Minimum Cost Flow Problem, Network Simplex Method, Project Planning and Control I with PERT and cpm.

### **PSO -15 : Graph Theory (I)**

- To understand and apply the fundamental concept of Graph Theory.
- To apply Graph Theory based tools in solving practical problems.
- Graph Theory provides a helpful tool to quantify and simplify the many moving parts of dynamic system.

**The course of M.Sc. (Mathematics) Semester-IV** has been divided into five papers:-

### **PSO-16: Functional Analysis (II)**

- Gain Knowledge Uniform boundedness theorem and some its consequences, Open mapping and closed graph theorems.
- Develop the knowledge Solvability of linear equations in Banach spaces and the closed Range Theorem. • Learns the method Complete orthonormal sets and Parseval's identity.
- Identify types of Adjoint of an operator on a Hilbert space and Reflexivity of Hilbert spaces.
- Abstract variational boundary-value problem and the generalized Lax-Milgram theorem.

### **PSO-17: Partial Differential Equations and Mechanics (II)**

- Understand Non-linear First Order PDE-Complete Integrals, Envelopes, Characteristics, Hamilton Jacobi Equations.
- Solve Fourier and Laplace Transform, Hopf-Cole Transform, Hodograph and Legendre Transforms, Potential Functions.
- Learns about Asymptotics (Singular Perturbations, Laplace's Method, Geometric Optics, Stationary Phase, Homogenization).
- Solve Jacobi's equations, Lee Hwa Chung's theorem, canonical transformations and properties of generating functions.
- Gain Knowledge Lagrange Brackets, and Condition of canonical character of a transformation in terms of Lagrange brackets and Poisson brackets

### **. PSO-18: Cosmology (II)**

- Study Cosmology-Mach's principle, Einstein modified field equations with cosmological term.
- Students learns about Static Cosmological models of Einstein and De-Sitter, their derivation, properties and comparison with the actual universe.
- Gain knowledge about Hubble's law, Cosmological principles, Weyl's postulate and Derivation of Robertson-Walker metric.
- Understand Friedmann models, Fundamental equations of dynamical cosmology and Critical density.
- Study Einstein-deSitter model, particle and event horizons.

### **PSO-19: Operations Research (II)**

- Understand Dynamic Programming-Deterministic and Probabilistic Dynamic programming.
- Solve Game Theory-Two-Person, Zero-Sum Games. Games with Mixed Strategies.
- Gain knowledge about Integer Programming-Branch and Bound Technique.
- Learns the basic concept of Applications to Industrial Problems-Optimal product mix and activity levels.
- Study Nonlinear Programming-One/and Multi-Variable Unconstrained Optimization, KuhnTucker Conditions for Constrained Optimization.

### **PSO-20: Graph Theory (II)**

- Study about the concept of Ramsey Theory.
- Study about Permutation groups, Automorphism groups and their graphs also Pseudo-similarity and stability.
- Study of The Colour polynomials, The Chromatic polynomial and the Bivariate colouring polynomials. Study about the concept of Digraphs, Networks & Menger's and Konig's Theorem.

## **Program Outcomes (PO) for MSc. Zoology Paper**

Zoology is that branch of science which deals with the study of the animal kingdom. The branch deals with the structure, embryology, evolution, classification, habits, and distribution of all animals, both living and extinct. For someone who is interested in making a career in Zoology will be required to deal with both the existing, dead and quite possible the extinct species of the animal kingdom. This study is carried out in several branches of Zoology such as Environmental Biology and Ecology. There is a lot of scope in Zoology. A Zoology student can get into diverse sectors like animal biodiversity prospecting, Bioinformatics, Ecosystem Monitoring, Wildlife Conservation and Environmental Management. In the campus of Bhilai Mahila Mahavidyalaya the Post graduate course in MSc. Zoology has been started since 2001. Initially it has been started with the annual system examination pattern than after 2010 it's started with semester pattern. Four theories and 2 Lab Course has been incorporated with each semester.

After successful completion of three year degree programme in Chemistry students should be able to:

PO1 Ph.D. needs to qualify National Eligibility Test (NET) for Junior Research Fellow (JRF) for the fellowship in the field of research

PO2 After qualifying National Eligibility Test (LS) candidate eligible for lectureship in Colleges

PO3 Apart from those students can join schools after doing B.Ed.

PO4 On choosing this career, the person specializing in the field will be referred to as a Zoologist. On being a part of this field, one, will be carefully have to study the behavior, characteristics, evolutionary trends of the different species of animals and those factors having a direct impact on them.

## **Program Specific Outcomes (PSO) for MSc Zoology Paper**

**PSO1** Through the syllabus of Msc Zoology students understand the nature and basic concepts of cell biology, Genetics, Taxonomy, Neuro Physiology, Endocrinology, Developmental Biology, Animal Behavior, Population ecology, Invertebrates structure and Function, Computational Biology, Animal Physiology, Immunology and applied Zoology.

**PSO2** Lab experiment with relationships among animals, plants and microbes has been performed in the department. Field Experiment has also been performed for the Ecology and Biodiversity practices.

**PSO3** Students Perform procedures as per laboratory standards in the areas of Classical and modern zoology such as Structural Invertebrates, Taxonomy, Physiology, Ecology, Cell and Molecular Biology, Genetics, Applied Zoology, Clinical science, tools and techniques of Zoology, Toxicology, Immunology, Comparative Biology, Biochemistry, Fish biology, Animal biotechnology, Immunology and research methodology. Understand the applications of biological sciences in Apiculture, Aquaculture, Agriculture and Medicine.

**PSO4** Here, Specialization paper in **Molecular Endocrinology and Neurophysiology** through this paper the students gain fundamental and technical knowledge of such field.

**PSO5 Molecular Endocrinology:** Through this specialized paper of MSc Zoology we describe the dynamic symphony of feedback regulation and cellular actions of the circulating hormones of the endocrine system contributes to the internal homeostasis of the human body. We discuss several disease topics in endocrinology of particular importance to men's health, as well as an evidence-based approach to their diagnosis and treatment.

**PSO6 Neurophysiology:** Through this specialized paper of MSc Zoology we discuss about the study of the functional properties of neurons, glia, and networks. Historically it has been dominated by electrophysiology—the electrical recording of neuronal events ranging from the molar (the electroencephalogram, EEG) to the cellular (intracellular recording of the properties of single neurons). However, as the neuron is an electrochemical machine, it is impossible to separate electrical events from the biochemical and molecular processes that bring them about. Thus neurophysiologists today use techniques from chemistry (calcium imaging), physics (functional magnetic resonance imaging, fMRI), and molecular biology (site directed mutations) to study brain function. As we shall see, the use of *in vitro* techniques has facilitated all aspects of modern neurophysiology and can be fairly stated to have permitted many of them.

## **Course Outcomes (CO) for MSc. Zoology Paper**

### **Semester I**

#### **PAPER – I BIOSYSTEMATICS, TAXONOMY AND BIODIVERSITY**

CO1 Describe taxonomy intends to classify living creatures.

CO2 Taxonomy helps to ascertain the no. of living species on the earth.

CO3 Taxonomy assists in getting an idea of what types of characters are present.

CO4 Gives a concept of local species.

CO5 Taxonomy provides the fundamental foundations of preservation practice and sustainable management of the world's remaining resources

#### **PAPER-II: STRUCTURE & FUNCTION OF INVERTEBRATES**

CO1 Imparts knowledge regarding the various Invertebrates species and the regulatory processes to safeguard them

CO2 With the study of this paper students gain knowledge in the areas of responses to Systematic position, general organization and affinities of Ctenophora and Nemertea

CO3 Rhynchoceola; Systematic position, general organization and affinities of Rotifera

CO4 Systematic position, general organization and affinities of Hemichordata

#### **PAPER-III: POPULATION GENETICS & EVOLUTION**

CO1 Population genetics is intimately bound up with the study of evolution and natural selection.



**CO2 Theoretical cornerstone of modern Darwinism**

**CO3** Natural selection is one of the most important factors that can affect a population's genetic composition.

**CO4** description about patterns and mechanisms of reproductive isolation, Phylogenetic and biological concepts of species, Gene Evolution, Evolution of gene families, Factors affecting human disease

#### **PAPER-IV TOOLS & TECHNIQUES IN BIOLOGY**

**CO1** New tools and techniques were invented which helped in the study of finer structure of various kinds of organisms and their parts.

**CO2** Describe how Biologists depend heavily on a number of tools and techniques for studying organisms and their use of research

**CO3** In this paper we describe the history of biology, various new tools and techniques have developed, like microscopy, paper chromatography, Electrophoresis, chemical tools, Cell Culture method, etc.

**CO4** Understanding of basic concepts of instrumentation such as cell fractionation, homogenation and centrifugation. Students gain skills in histological, immunological and electrophysiological technique

### **Semester II**

#### **PAPER – I: MOLECULAR CELL BIOLOGY AND BIOTECHNOLOGY**

**CO1** Structural and functional aspects of basic unit of life i.e. cell concepts

**CO2** Mendelian and non mendelian inheritance

**CO3** Concept behind genetic disorder, gene mutations- various causes associated with inborn errors of metabolism

**CO4** Imparts the Knowledge to culture animal cells in artificial media. animal cells in culture, growth of cell lines. recombinant DNA technology, genetic manipulations and in a variety of industrial processes

#### **PAPER – II: GENERAL PHYSIOLOGY AND ENDOCRINOLOGY**

**CO1** Seeks to understand the mechanisms that work to keep the human body alive and functioning

**CO2** Physiological and biochemical understanding through scientific enquiry into the nature of mechanical, physical, and biochemical functions of humans, their organs, and the cells of which they are composed

**CO3** Interactions and interdependence of physiological and biochemical processes

**CO4** Students learn the concepts of endocrine systems and homeostasis a brief account of genetics and organic evolution.

#### **PAPER – III: DEVELOPMENT BIOLOGY**

CO1 Knowledge about genetics, developmental biology and organogenesis

CO2 Gains knowledge about gametogenesis, cleavage mechanisms, gastrulation and role of hormones in metamorphosis and regeneration

CO3 Description about Utility and comparative topographical relationship of the Presumptive areas in early embryos of Amphioxus, Fishes, Amphibian, Birds

CO4 Theory and experimental concept about Cell and tissue interactions in development, Primary embryonic induction, Competence, Concept of organizer, Metamorphosis and Teratology

#### **PAPER – IV: QUANTITATIVE BIOLOGY AND COMPUTER APPLICATION**

CO1 Students gain skills in basics of computers, operating systems,

CO2 Overview of programming languages

CO3 Application of internet and statistical bioinformatics in research

CO4 Data analysis by using different software

### **Semester III**

#### **PAPER-I: COMPARATIVE ANATOMY OF VERTEBRATES**

CO1 Understanding of origin and salient features of Ostracoderms to Actinopterygii, adaptive radiation of Amphibians, Reptiles, birds and Mammals

CO2 Gains knowledge of functional anatomy of vertebrates from fishes to mammals

CO3 Understanding of evolutionary significance of internal fertilization, neoteny and paedogenesis

CO4 Identifies the significance of amniotic egg its structure and evolutionary significance of skeletal system

#### **PAPER-II: ANIMAL BEHAVIOUR**

CO1 **Describe Ethology, Innate and Immune behavior of animals**

CO2 Understand Animal behaviour and response of animals to different instincts

CO3 Interaction of biota abiota

CO4 Various kinds of Animal adaptations, migration etc.

#### **PAPER – III: ENVIRONMENT PHYSIOLOGY AND POPULATION ECOLOGY**

CO1 Distribution of fauna in different realms interaction

CO2 Imparts knowledge to the student regarding environment and conservation biology.

CO3 Gains knowledge in the areas of responses to Laws of limiting factor, Laws of minimum, Laws of Tolerance and Tragedy of commons

CO4 Types of ecosystem – freshwater, marine and terrestrial, Population characteristics and dynamics – conceptual approach, Growth curves and pyramids; sigmoid curve, J curve and hyperbola; logistic equation and concepts relating to growth.

#### **PAPER – IV: IMMUNOLOGY AND PARASITISM**

CO1 Provides basics knowledge about immune system and allows the student to create insight as how to improve their immune system and good health.

CO2 Types of immunity, antigens-antibodies and their properties

CO3 Complement system, MHC's and immune responses, Understanding of types of hypersensitivity reactions and auto immune diseases

CO4 Ability to understand concepts of tumor immunology and transplantation immunology and provides basics knowledge about parasites and parasitic disease

#### **Semester IV**

##### **PAPER– I: (Compulsory) BIOCHEMISTRY**

CO1 Describe about the chemical and physicochemical processes occurring within living organisms.

CO2 Gain knowledge about nucleic acids, proteins, carbohydrates and lipids and their metabolism.

CO3 Experimental bases knowledge provided through techniques such as protein purification, homogenization, enzyme assay, chromatography, etc.

CO4 learn about Biosynthesis pathway of Vitamins (Water and Fat soluble vitamins, Chemistry, occurrence and physiological role) and Enzymes (Classification and nomenclature, Mechanism of action Regulation of enzyme activity and functions of Co-enzyme)

##### **PAPER II: (Compulsory) NEUROPHYSIOLOGY**

CO1 Imparts knowledge about various metabolic and physiological mechanisms of the human body.

CO2 Understands about neurophysiology and receptors

CO3 Gain knowledge about hormones and bioluminescence

CO4 Understand the complete function of different types of Nervous system such as Autonomic nervous system; sympathetic and para-sympathetic nervous system with special comparison to hormonal mechanism of transmission through autonomic nervous system, Reflex action; verities, characteristics, unconditional reflex, electrophysiology of spinal reflexes , Sensation, Electro encephalography and its physiological basis

##### **PAPER III: CELL BIOLOGY**

CO1 Describe basic knowledge about the Molecular biology and their importance in the fields of Biological Science

CO2 Describe about the formations, actions, and regulations of various parts of cells which can be used to efficiently target new drugs, diagnose disease, and understand the physiology of the cell.

CO3 Explanation about basic knowledge of Eukaryotic transcription of Eukaryotic

transcriptional control, Environmental modulation of gene activity, DNA rearrangement.

CO4 Study of developmental stage of Drosophila, Cleavage, Gastrulation, Origin of Anterior – Posterior (Maternal effect genes and segmentation genes, Drosophila development II origin of dorsal ventral polarity, Basic idea of homeotic selector genes and homeotic mutation, Basic idea of organization of homeoboxes, Evolutionary significance of homeoboxes

#### **Paper IV: Molecular Endocrinology and Reproductive Technology**

CO1 Describe basic knowledge about the Endocrine gland, mechanism of hormone action, hormone control and gene expression

CO2 Gain knowledge about the surgical techniques and IVF techniques and other related surgery of reproduction

CO3 Understand and describe about: Hormone – Transduction, G-Protein & Cyclic Nucleosides, Calcium calmodulin & phospholipids, Miscellaneous Second Messengers, Phosphorylation & other non-transcriptional effect of Hormones, Genetic control of formation of Hormone, Transcription. Post transcription, Translation, Post translation, Secretion of Hormone.

CO4 Explain and describe about: Multiple ovulation and embryo transfer Technology. Study of estrous cycle by vaginal smear technology and different Surgical technique

### **M.Sc. Biotechnology**

#### **OUTCOMES OF BIOTECHNOLOGY**

##### **Programme outcome (POs):**

The B.Sc and M.Sc. Program of Biotechnology at Bhilai Mahila Mahavidyalaya, Bhilai, started in 2004 and 2006, aims to train students in Biotechnology wherein engineering and technology principles could be used to probe biological questions or to develop technologies, devices and systems that require substantive expertise in Biology, Agriculture, Pharmaceutical, Industrial, as well as Clinical Research components. The students in this program acquire knowledge, critical thinking skills and experience in conducting cutting edge research.

##### **Programme Specific Outcomes (PSOs):**

**PSO1:** Postgraduate students will be able to demonstrate and apply their knowledge of cell biology, biochemistry, microbiology and molecular biology to solve the problems related to the field of biotechnology.

**PSO2:** Postgraduate students will be able to demonstrate and apply the principles of bioprocess engineering in the design, analysis, optimization and simulation of bioprocess operations.

**PSO3:** Students will be able to gain fundamental knowledge in animal and plant biotechnology and their applications.

**PSO4:** Students will be equipped to understand three fundamental aspects in biological phenomenon: a) what to seek; b) how to seek; c) why to seek?

**PSO5:** Student will be able to (a) Describe fundamental molecular principles of genetics; (b) Understand relationship between phenotype and genotype in human genetic traits; (c) Describe the basics of genetic mapping; (d) Understand how gene expression is regulated.

**PSO6:** Students will be able to (a) To elaborate concepts of biochemistry with easy to run experiments; (b) To familiarize with basic laboratory instruments and understand the principle of measurements using those instruments with experiments in biochemistry.

**PSO7:** Students will be able to understand various facets of molecular procedures and basics of genomics, proteomics and metabolomics that could be employed in early diagnosis and prognosis of human diseases.

**PSO8:** Students will be able to gain hands on experience in gene cloning, protein expression and purification. This experience would enable them to begin a career in industry that engages in genetic engineering as well as in research laboratories conducting fundamental research

**Course Outcomes:** On the successful completion of the subject, the student get an overall understanding of structure of atoms, molecules and chemical bonds, Gains knowledge on enzyme kinetics. Understands biopolymers and metabolic reaction in the living systems. To understand Cellular structure, biostatics analysis, bioprocessing engineering, Genetics analysis and usage of instruments in experiments for future research.

### **COS1: Cell Biology**

- Understand the importance, evolution and diversity of cells.
- Learns to visualize the cells by employing different types of microscopes.
- Able to describe the organization, structure and functions of cell organelles.
- Understand the biochemical pathways associated with the cellular organelles.
- Rationalize different transport mechanisms occurring in the cell.
- Understand the cell signaling mechanisms.
- Perceive over all mechanism of cell growth and cell cycle and division.
- Understand the sequential events that occur during mitosis and meiosis.
- Introduce the concepts of stem cell and cell culturing techniques.
- Sensitized on cancer types, oncogenes and tumor suppressor genes.

### **COS2: Genetics**

- Learn the basics of classical, molecular and evolutionary genetics.
- Understands the process of Genetic Recombination – and the elements of recombination in E. coli, RecA, RecBCD.
- Knowledge on DNA Structure and its variations, properties and modification of DNA.
- Learning the genetic changes due to mutations- Point Mutations, Deletions, Insertions, and Damage, DNA repair and recombination.
- Overview of DNA packaging; Synthesis and processing of RNA and proteins; Regulation of gene expression.
- Knowledge on the repetitive DNA sequences and transposable elements; Promoters and methods of isolation; Transcription factors- their classification and role in gene expression.
- Understands genetic systems - Growing cells for genetics experiments - Genetic Selections - Mapping with Generalized Transducing Phage.
- Learning the principles of Bacterial Sex.
- Knowledge on the elements of Yeast and Drosophila Genetics.
- Learning the tools for plant molecular genetics - Epigenetic control of gene expression.
- Details of the regulatory RNA and their role in gene regulation - Small RNAs, RNA interference and its applications.

### **COS3:Microbial Physiology**

- The student will be able to understand microbial diversity; physiology and nutrition.
- The student will be able to identify microbes using modern techniques.

### **COS4:Biomolecules**

- To understand the concept of biochemical regulations.
- Describe the structure and function of DNA and RNA in the cell
- To differentiate the structure of nucleic acid, types of Nucleic acid and its Forms.
- To differentiate between eukaryotic and prokaryotic chromosomal structure.
- Describe the structure of proteins, including the significance of amino acid R-groups and their impact on the three-dimensional structure of proteins.
- Students will have knowledge on biomolecules, their importance and Classification, forces stabilizing their structures, write and relate the role of them with day to day life.

### **COS5:Biostatics & computer**

- Students can apply basic concept of biostatistics for various research purpose.

- Understand simple calculations.
- How to plan and execute research designs.
- Analyse data, interpret, and present information.
- Publishing research data Calculate; analyse and compare observed data; perform simple sums in proportions and algebraic function.

### **COS6:Molecular Biology Genetic Engineering and Immunology**

- To explain genome organization in higher organisms.
- To describe kinetic classes of DNA and Gene families.
- To understand the steps involved in recombinant DNA technology.
- To explain the construction of DNA & c DNA library and their applications.
- To get insight in Primary and Secondary organs of Immune system.
- To describe antibody-antigen interaction, autoimmune diseases.

### **COS7:Plant Tissue Culture**

- Learning important milestones in the plant tissue culture.
- Understanding the concepts and principles of Plant tissue culture.
- Learning the techniques of sterilization and monitoring method of sterilization.
- Learning different pathways of plant regeneration under in vitro conditions - organogenesis and somatic embryogenesis.
- Techniques of establishing cell suspension culture. Synthetic seeds and applications.
- Understanding the techniques of virus elimination – methods of virus indexing. Meristem and Shoot tip culture and Applications.
- Performing procedures for Micro propagation techniques.
- Culturing of reproductive structures - anther, microspores, embryos, endosperm, Ovule and ovary cultures and methods to produce haploids.
- Protoplast isolation, culture and protoplast fusion - applications -. Somaclonal variation - applications.
- Learning methods to conserve germplasm under In vitro. Production of Secondary metabolites production through cell culture.

### **COS8:Bioprocess Engineering**

- Plan a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up. Apply modeling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.
- Aware of various methodologies for biomass production.
- Product isolation using various analytical methods.

### **COS9:Animal Tissue Culture**

- Understand principles of plant and animal culture, media preparation and can explain invitro fertilization and embryo transfer technology, meristem culture and clonal propagation of plant.
- Know how transgenic animals, cryopreservation, apoptosis, animal cloning, cell transformation, DNA microinjection, production of vaccines is done.
- Students will have an insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins and can describe commercial production of fuels, microbial enzymes and can apply them in research work.

### **COS10:Genomics and Proteomics**

- Exposed to various strategies and methods of genome sequencing.
- Students will be able to browse whole genome databases.
- Will be able to conduct gene expression profiling.
- Learn various bioinformatics tools of genomic data analysis.
- Learn on assigning gene function through mutagenesis and genetic engineering.
- Will learn how the genome research can be applied in crop improvement research.

### **COS11:Biosafety and Bioethics**

- Detailed description on global status of genetically engineered crops, Asimolarconference on rDNA technology.
- Brief description on the concerns of GE crops – animal and human health, environment, agriculture, horizontal gene transfer and general concerns.
- Principles of safety assessment of transgenic plants and sequential steps in risk assessment.
- Concepts of familiarity and substantial equivalence.
- Environmental risk assessment and food and feed safety assessment.
- International biosafety regulations, Cartagena protocol, OECD consensus documents and Codex Alimentarius.
- Indian biosafety regulations, Biosafety research trials and GM labeling.
- Brief description on bioethics, ethical issues on GM crops, Nuffield council on bioethics.

### **COS12:Skill Development**

- Capacity building and skill development of the students in planning, development, formulation, monitoring and evaluation of project for entrepreneurial proficiency.
- Learn specific techniques on Plant Biotechnology/Bioinformatics and get hands-on training on the research theme of the host industry/institution.



- Develop communication skills through inter-personal interactions with lab members at the host institute and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

### **COS13:Project formulation, Execution and Presentation**

- Students learn to analyse the researchable problems and devised strategies to overcome in project mode.
- Formulate project proposal with key indicators for monitoring the progress.
- Learn to execute the project and perform mid-term corrections as alternative strategies.
- Helps students learn general conduct and discipline of working in team environment in lab.
- Inculcates creativity in the execution of the project and presentation.

### **COS14:Educational Tour**

- Exposure to leading national and international institutions and their working environment and the state-of the art facilities.
- Learn on the different agro-climatic zones across India and the cropping pattern in various parts of India.
- Develop communication skills by interactions with their faculty and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

### **Entrepreneurial Development in Biotechnology**

- Entrepreneurial Development in Biotechnology for a period of 10 weeks On-campus/Off-campus in one of the following skill development courses based on students interest.
- Micropropagation of Commercially Important Crops.
- Secondary Metabolite Production from Plant Cell Cultures.
- Molecular Diversity Analysis of Plants and their Associated Organisms.
- Marker-assisted Introgression of Target Genes.
- Bioprospecting for Novel Biomolecules / Genes.

- Isolation and Characterization of Agronomically Important Genes.
- Genetic Transformation and Evaluation of Transgenic Plants for Stress Resistance.
- Recombinant Protein Production in Microbial Systems
- Students learn tools and techniques in various modules of biotechnology.
- Perform procedures for the De novo and reference based assembly, Genome finishing and annotation.
- Develop ability to plan and perform experiments.
- Inculcates the team learning environment when students are posed with challenging tasks.
- Ability to formulate winning project proposals for establishing independent firms.
- Knowledge on resource mobilization, cost analysis and economics of the project.

➤ **Biotechnology Learning Outcomes**

- ✓ **Cognitive Knowledge:** To provide education that leads to comprehensive understanding of the principles and practices of biotechnology.
- ✓ **Information and Computer Literacy:** To educate and make them up to date with the current scientific literature, computer programs and web information.
- ✓ **Experimental Skills:** To provide broad based training in technical skills in methods of biotechnology.
- ✓ **Critical Thinking:** To empower students with the ability to think and solve problems in the field of biotechnology.
- ✓ **Scientific Communication:** To ensure students are able to effectively communicate with biotech and other interdisciplinary professionals.
- ✓ **Professional Attitude:** To produce responsible biotechnologists that can work within the interdisciplinary framework of biotechnology and related fields.

## **M.Sc. Microbiology**

### **OUTCOMES OF MICROBIOLOGY**

#### **Programme Outcome (PSOs)**

The B.Sc. and M. Sc. Program in Microbiology at Bhilai Mahila Mahavidyalaya started in 2004 and 2006 aims to train students in Microbiology where in medical, handling in microbial sample could be used to probe biological questions and required substantive expertise in Biology, Agricultural, and Fermentation Technology as well as Clinical Research component. The students in this program acquire knowledge in critical thinking skill and experience in conducting cutting edge research.

#### **Programme Specific Outcomes (PSOs)**

**PSO1:** Understand the contributions of various scientists in microbiology and scope of various branches.

**PSO2:** Understand various kinds of prokaryotic & eukaryotic microbes and their interaction.

**PSO3:** Explain and describe importance of organic compounds and its chemistry found in living cells.

**PSO4:** Understand and explain various processes of metabolism of carbohydrates amino acids and vitamins.

**PSO5:** Explain DNA, RNA and protein structure and their synthesis.

**PSO6:** Understand the concept of disease development, spread, control and eradication from society.

**PSO7:** Understand the basic concepts of gene and their regulation of action

**PSO8:** Explain and write various industrial fermentations and bioinstrumentation.

**Course Outcome (COS):** On the successfully completion of the subjects the students get an overall understanding of cellular organization, life cycle and organization of Prokaryotic and Eukaryotic cells, Structure of Protein and Carbohydrates. As well as practical handling in different fields like running Electrophoresis, Estimation by Spectrophotometer, DNA and RNA isolation, Calculation of BOD and COD of water samples, Counting of coli form Bacteria.

**COS 1: General Microbiology & Microbial Physiology**

- Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures.
- Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also understand the structural similarities and differences among various physiological groups of bacteria/Achaea.
- Know various Culture media and their applications and also understand various physical and chemical means of sterilization.
- Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae.

- Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively.
- Comprehend the various methods for identification of unknown microorganisms.
- Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy.
- Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

## **COS 2: Cell Biology**

- Understand the importance, evolution and diversity of cells.
- Learns to visualize the cells by employing different types of microscopes.
- Able to describe the organization, structure and functions of cell organelles.
- Understand the biochemical pathways associated with the cellular organelles.
- Rationalize different transport mechanisms occurring in the cell.
- Understand the cell signaling mechanisms.
- Perceive over all mechanism of cell growth and cell cycle and division.
- Understand the sequential events that occur during mitosis and meiosis.
- Introduce the concepts of stem cell and cell culturing techniques.
- Sensitized on cancer types, oncogenes and tumor suppressor genes.

## **COS 3: Bioenergetics and Metabolism**

- Describe the concepts of electrolytes and electrolytic dissociation, pH and its biological significance, buffers, Henderson-Hasselbalch equation, biological buffer systems and their importance.
- Understanding the laws of thermodynamics, concepts of entropy, enthalpy and free energy changes and their application to biological systems and various biochemical studies and reactions.
- Conceptual knowledge of aerobic and anaerobic respiration and various intermediary mechanisms involved, oxidative phosphorylation.
- Overview of major biomolecules –carbohydrates, lipids, proteins, aminoacids, nucleic acids, classification, structure, function of the above mentioned biomolecules.
- Discuss the biosynthesis and the degradation pathways involved.
- Specify the biological significance of biomolecules in metabolism.
- Conceptual knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation, enzyme engineering, Application of enzymes in large scale industrial processes.

## **COS 4: Molecular Biology and Microbial Genetics**

- Know the terms and terminologies related to molecular biology and microbial.
- Understand the properties, structure and function of genes in living organisms at the molecular level.
- Explain the significance of central dogma of gene action.
- Have a conceptual knowledge about DNA as a genetic material, enzymology, and replication strategies.
- Understand the molecular mechanisms involved in transcription and translation.
- Describe the importance of genetic code and wobble hypothesis.
- Discuss the molecular mechanisms underlying mutations, detection of mutations and DNA damage and repair mechanisms.
- Explain the concept of recombination, linkage mapping and elucidate the gene transfer mechanisms in prokaryotes and eukaryotes.
- Handle and independently work on lab protocols involving molecular techniques.

### **COS 5: Environmental & Agriculture Microbiology**

- Appreciate the diversity of microorganism and microbial communities inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
- Learn the occurrence, abundance and distribution of microorganism in the environment and their role in the environment and also learn different methods for their detection and characterization.
- Competently explain various aspects of environmental microbiology and microbial ecology and to become familiar with current research in environmental microbiology.
- Understand various biogeochemical cycles – Carbon, Nitrogen, Phosphorus cycles etc. and microbes involved.
- Understand various plant microbes interactions especially rhizosphere, phyllosphere and mycorrhizae and their applications especially the biofertilizers and their production techniques.
- Understand the basic principles of environment microbiology and be able to apply these principles to understanding and solving environmental problems – waste water treatment and bioremediation.
- Know the Microorganisms responsible for water pollution especially Water-borne pathogenic microorganisms and their transmission.
- Comprehend the various methods to determine the Sanitary quality of water and sewage treatment methods employed in waste water treatment.

### **COS 6: Immunology**

- Demonstrate an understanding of key concepts in immunology.

- Understand the overall organization of the immune system.
- Conceptualize how the collection of individual clones of lymphocytes (termed the “immune repertoire”) arises from rearrangement within two genetic loci: the Ig gene in B cells and the antigen receptor in T cells.
- Learn how “clonal selection” allows for the expansion of a limited number of antigen-recognizing lymphocytes in response to a specific antigenic stimulus.
- Begin to appreciate the significance of maintaining a state of immune tolerance sufficient to prevent the emergence of autoimmunity.
- To understand about Tumor Immunology and help the students to understand its immune prophylaxis and immune therapy.
- To make them understand the salient features of antigen antibody reaction & its uses in diagnostics and various other studies.
- Learn about immunization and their preparation and its importance.
- Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read graphs, and understand and use information from scientific papers.
- Demonstrate skill in communication of scientific data in standard format.

### **COS7: Food Microbiology**

- Understand the beneficial role of microorganisms in fermented foods and in food processing and the microbiology of different types of fermented food products – dairy, pickles, Legume and cereal based food products.
- Understand the significance and activities of microorganisms in food and role of intrinsic and extrinsic factors on growth and survival of microorganisms in foods.
- Know the spoilage mechanisms in foods and thus identify methods to control deterioration and spoilage.
- Recognize and describe the characteristics of important pathogens and spoilage microorganisms in foods.
- Learn various methods for their isolation, detection and identification of microorganisms in food and employ in industries.
- Identify ways to control microorganisms in foods and thus know the principles involving various methods of food preservation.
- Understand of the basis of food safety regulations and discuss the rationale for the use of standard methods and procedures for the microbiological analysis of food.
- Acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.

### **COS 8: Medical Microbiology**

- This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.
- It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal Microflora.
- The course provides the conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause disease in the human body.
- It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.
- To understand the importance of pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.
- Helps to understand the use of lab animals in medical field.
- Recall the relationship of this infection to symptoms, relapse and the accompanying pathology. Explain the methods of microorganisms control, e.g. chemotherapy & vaccines. Solve problems in the context of this understanding.

### **COS 9: Advances in Biotechnology**

- To know the basics and concepts of various biotechnological related terms.
- Explain the physiological processes that occur during plant growth and development describe the methodology involved in plant tissue culture and plant transgenic.
- Discuss issues related to plant nutrition, quality improvement, environmental adaptation, transgenic crops and their use in agriculture.
- Elucidate the significance of transgenic plants as bioreactors for the production of enzymes, plant bodies, edible vaccines and therapeutic proteins.
- Address bioethical and biosafety issues related to plant transgenic.
- Understand, conduct and gain a thorough knowledge to perform plant tissue culture experiments.
- Explain the basics of animal biotechnology.
- Elucidate the molecular techniques involved in gene manipulation and rDNA technology
- Explain the gene transfer methods for the production of transgenic animals.
- Address bioethical and biosafety issues related to animal transgenic.
- Gain experimental knowledge to perform animal biotechnology related experiments.
- Elucidate the concept of Nano size, nanoparticle its structure and properties of nanoparticles.



- Connect the concepts of physics, chemistry and engineering principles in the study the nano scale nature of the particles.
- Explain the process protocol for the, synthesis and characterization of nanoparticles.
- Discuss the applications of nanoparticles in allied fields.
- Acquire knowledge and lab skills to perform nanotechnology experiments in lab.
- Explain the application of biotechnology in medical and its allied fields, gene therapy , genetic counseling.
- Acquire knowledge about antisense technology, Pharmacogenetics, Toxic genomics, Tissue engineering, Bimolecular engineering and the impact of these novel strategies on human population.
- Address the bioethical issues & concerned linked to medical biotechnology.

### **COS10: Biostatics & computer**

- Students can apply basic concept of biostatistics for various research purpose.
- Understand simple calculations.
- How to plan and execute research designs.
- Analyze data, interpret, and present information.
- Publishing research data Calculate; analyze and compare observed data; perform simple sums in proportions and algebraic function.

### **COS 11: Fermentation Technology**

- Get equipped with a theoretical and practical understanding of Fermentation Technology.
- Appreciate how microbiology is applied in manufacture of industrial products.
- Know how to source for microorganisms of industrial importance from the environment.
- Know about design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer.
- Understand the rationale in medium formulation & design for microbial fermentation, sterilization of medium and air.
- Appreciate the different types of fermentation processes.
- Understand the biochemistry of various fermentations.
- Identify techniques applicable for Improvement of microorganisms based on known biochemical pathways and regulatory mechanisms.
- Comprehend the techniques and the underlying principles in downstream processing.

### **COS 12: Skill Development**

- Capacity building and skill development of the students in planning, development, formulation, monitoring and evaluation of project for entrepreneurial proficiency.
- Learn specific techniques on Plant Biotechnology/Bioinformatics and get hands-on training on the research theme of the host industry/institution.
- Develop communication skills through inter-personal interactions with lab members at the host institute and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

### **COS 13: Project formulation, Execution and Presentation**

- Students learn to analyse the researchable problems and devised strategies to overcome in project mode.
- Formulate project proposal with key indicators for monitoring the progress.
- Learn to execute the project and perform mid-term corrections as alternative strategies.
- Helps students learn general conduct and discipline of working in team environment in lab.
- Inculcates creativity in the execution of the project and presentation.

### **COS 14: Educational Tour**

- Exposure to leading national and international institutions and their working environment and the state-of the art facilities.
- Learn on the different agro-climatic zones across India and the cropping pattern in various parts of India.
- Develop communication skills by interactions with their faculty and broaden knowledge.
- Motivate students by exploring the possibilities and future career in the science pursuit.
- Inculcates general discipline and mass conduct among students when they move as teams.

### **Entrepreneurial Development in Microbiology**

- Entrepreneurial Development in Microbiology for a period of 10 weeks On-campus/Off-campus in one of the following skill development courses based on students interest.

- Microbiology has expanded to include many diverse focuses as people begin to appreciate and accept the importance of microbes in our everyday lives.
- The emergence of new technologies and services in the field of synthetic biology has created opportunities for microbiologists to do so much more, quicker and at a lower cost.
- Many students of microbiology are making their startup in the area of bio fertilizers and bio nutrient manufacturing unit.
- Commercialization of microbial product had open many opportunities in the field of Microbiology.
- Exploiting microbes can be highly lucrative in terms of entrepreneurship in the field of microbiology.
- Students learns tools and techniques in various modules of Microbiology.
- Perform procedures for the De novo and reference based assembly, Genome finishing and annotation.
- Develop ability to plan and perform experiments.
- Inculcates the team learning environment when students are posed with challenging tasks.
- Ability to formulate winning project proposals for establishing independent firms.
- Knowledge on resource mobilization, cost analysis and economics of the project.
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### **Microbiology Learning Outcomes**

- ✓ ***Nature of Science and Scientific Inquiry:*** Microbiology majors should be able to discuss science and scientific methodology as a way of knowing. Microbiology majors should make observations, develop hypotheses, and design and execute experiments using appropriate methods. They should be able to explain how the nature of science is applied to everyday problems.
- ✓ ***Laboratory Skills:*** Microbiology students should master the following laboratory skills: aseptic and pure culture techniques, preparation of and viewing samples for microscopy, use appropriate methods to identify microorganisms, estimate the number of microorganisms in a sample, and use common lab equipment. They should practice safe microbiology, using appropriate protective and emergency procedures.
- ✓ ***Data analysis skills:*** Microbiology majors should be able to systematically collect, record, and analyze data, identify sources of error, interpret the results, and reach logical conclusions. They should be able to appropriately format data into tables, graphs, and charts for presentation and publication.
- ✓ ***Critical Thinking Skills:*** Microbiology majors should be able to (1) differentiate between fact and opinion, (2) recognize and evaluate author bias and rhetoric, (3) develop inferential skills, (4) recognize logical fallacies and faulty reasoning, and (5) make decisions and judgments by drawing logical conclusions using sound quantitative and statistically-based reasoning.
- ✓ ***Problem-Solving Skills:*** Microbiology majors should be competent problem-solvers. They should be able to assess the elements of a problem and develop and test a solution based on logic and the best possible information. Microbiology students should be able

to analyze and interpret results from a variety of microbiological methods, and apply these methods to analogous situations. They should use mathematical and graphing skills and reasoning to solve problems in microbiology.

- ✓ **Communication Skills:** Microbiology majors will demonstrate competence in written and oral communication.
- ✓ **Cooperation/Social Responsibility:** Microbiology majors should understand and appreciate the value of cooperating and working effectively with peers and be able to demonstrate a commitment to the process of developing such skills.
- ✓ **Values:** Microbiology majors should identify and discuss the ethical issues and responsibilities of doing science

## **M.Sc. (Home-Science) HD**

### **Program Outcome M.Sc. (Home-Science) HD Isem**

PO1: The students are given knowledge about various aspects of Human Development.

PO2: They are given concepts of research practices and are capable of taking up research projects.

PO3: To understand human behaviour, personality dynamics, emotions and socialization, students gain conceptual knowledge through related theories.

PO4: Education about characteristics of Early Childhood period dealing with children and understanding their needs is the benefit which students gets through this course.

PO5: They gain knowledge about skills and techniques in undergoing activities in ECCE.

PO6: The students undergoing this program gain knowledge about various trends and issues related to process of development amongst street children, adopted children, girl child and other stages of development and as a result develop awareness in such fields.

### **Program Specific Outcome M.Sc. (Home-Science) HD Isem**

#### **Paper I: Research Methodology**

PSO1: Objective of this paper is to understand the significance of Research methodology in Home science and to understand types, tools, methods of research and to develop the ability to construct data and make appropriate design,

PSO2: The students will gain knowledge about objectives of research and how to make social researches and surveys.

PSO3: After undergoing this program students will learn how to make different types of Hypothesis.

PSO4: The main purpose of research is to make an applicable research design which students can learn after going through this program.

PSO5: The most important criteria while doing research is sampling, classification, analysis and interpretation of data which can be conceptually understood if this program is undertaken by the students.

#### **Paper II: Theories of Human Development**

PSO1: The main objective behind choosing this program is to understand the importance of theories in Human Development, their practical application and discussion while dealing with physical, social, emotional and cognitive aspects.

PSO2: Historical theories especially Psychoanalytical theory and its cross cultural relevance is best understood while gaining in-depth knowledge of various theories.

PSO3: Enhancing learning by understanding learning theories, social learning theories is an important avenue if students study this program.

PSO4: In modern psychology cognition plays an important role in every field and cross cultural knowledge gained through this course help students become cognitive in various fields.

PSO5: Personality a dynamic organization could be enhanced if related theories are studied under this program.

#### **Paper III: Early Childhood Education**

PSO1: This program deals with gaining knowledge and insight related with principles of ECCE.

PSO2: The program help students learn importance of creativity how to assess and enhance it in children.

PSO3: This program also makes students efficient in psychometric measurements and also skills for parent education.

PSO4: Historical contribution of many thinkers read by students of this program help them applying the same in the formation of new education system.

PSO5: The students studying this program are capable of organizing preschool centers they have concepts of building, indoor outdoor equipment's and how to manage staff persons.

PSO6: Program planning an important aspect in Preschool education and its different criteria's are well understood if students take up this program.

PSO7: Under practical students of this course learn plan programs for providing science, music, storytelling etc. they test creativity of children psychological tests and are able to solve children's problems and parent's enquiries.

#### Paper IV: Current trends and issues in Human Development

PSO1: The program gives knowledge about trends and issues related to perceptual, cognitive, socio-emotional and language development.

PSO2: The students undergoing this program can deal with difficult circumstances of street children, migrant children, children with disability, orphans of corona pandemic.

PSO3: The students related with this program learn concept of self, self-esteem and are able to develop the same.

PSO4: Significance if birth changing roles and responsibilities with the growing age and cultural variation, influence of family, peers and school on the development of individual could be well dealt with students undergoing this program.

#### **Course Outcome M.Sc. (Home-Science) HD Isem**

CO1: The students after completing this course will be able to become Research associates and join Research projects.

CO2: In-depth knowledge to various theories develops insight in personality enhancement and learning cognitive styles which is the need of modern era.

CO3: The students after completing this course can plan to open their own preschools, play centers, day care centers, Montessori, kindergarten and other types of institutions for the welfare of the children.

CO4: Knowledge about object talk, picture talk, free conversation and creative activities of expression make them professionally good teachers, artists or orators.

CO5: The knowledge gained by students through this course can make them ideal social activist, planners and care takers.

CO6: This program develops students globally they could be research associates, theorists/psychologists, preschool planner's organizers and social reformers.

### **Program Outcome M.Sc. (Home-Science) HD IIsem**

PO1: The M.Sc. (Home-Science) HD is divided into 4 semesters in which they acquire knowledge about different fields of Human life.

PO2: The students after completing this course will have knowledge about parenting skills and techniques.

PO3: The students will develop concept of opening crèches and preschools.

PO4: The students will be able to help people in creativity and how to enhance creativity of children and students.

PO5: The students will understand the significance of statistics and research methodology in Home science research field. They will understand the types, tools, and methods of research learn to gather data and make appropriate research design.

### **Program Specific Outcome M.Sc. (Home-Science) HD IIsem**

#### Paper V – Statistics and Computer application

PSO1: The students will develop concept of statistical measures, classification and tabulation of the data.

PSO2: The students will develop components of computer and their working.

#### Paper VI – Adolescent Psychology

PSO1: After completing this program students will have concept of developmental task of each stage and way to help people cope up with problems.

PSO2: The students undergoing this program will have concept of family, community and culture and their influence on human beings.

PSO3: The in-depth knowledge about different types of electronic media and their importance in verbal and non-verbal communication.

PSO4: The students will have concept of delinquency its causes and prevention and other psychological disturbances such as depression, suicidal tendencies, substance abuse and prevention of AIDS along with causes associated with it.

#### Paper VII – Parenting in Early Childhood

PSO1: The art of Parenting is the need of this modern era and the students completing this program will be able to enhance the beauty of parenting skills.

PSO2: The students associated with this program have knowledge about how to undergo science activities and activities of social studies to strengthen the scientific and social concept among preschool children.

PSO3: The students will develop concept of creativity especially brain storming techniques, problem solving methods, creative dramatics and visualization.

PSO4: The role of parents both mother and father and their behaviour in moulding the child towards a desired direction can be easily understood after completion of this program.

PSO5: Development of self-awareness among children helping them control their emotions, establishing responsible behaviour and such interacting behaviours can be used and counseled if required to parents.

#### Paper VIII – Management and Project Planning

PSO1: The students will have idea of planning, monitoring and evaluating projects.

PSO2: After completing this program the students can apply or take a project at state level, national and even international level.

PSO3: The students if undergo this program will be able to explore nutritional problems of children, pregnant mothers and weaning mothers.

#### **Course Outcome M.Sc. (Home-Science) HD II sem**

CO1: The students who graduate with M.Sc. (Home Science) HD have overall knowledge about all stages of Human Development and have idea about how to take care during hazards at these stages.

CO2: They are trained in opening nursery schools, crèches, day care centers and aanganwadikendras.

CO3: During completion of this course they learn nursing new-born, taking care of children and characteristics of adolescence, adults and senior citizens and as a result they can psychologically counsel them and solve their problems systematically.

CO4: The students of this program have deeper insights in counseling and treating abnormal individuals.

CO5: Theoretical as well as interaction with counselors under practical assignments help students develop awareness in the fields of drawbacks of AIDS precautions to be taken and dealing with family violence cases.

CO6: The students of M.Sc. (Home Science) HD are given practical knowledge about how to write, monitor and evaluate projects as a result they could be project officers in various fields.

#### **Program Outcome M.Sc. III sem Human Development**



PO1: To give knowledge about guidance & counseling in human behavior.

PO2: Basic concept of advanced study on the field to students of Prenatal development, Infancy, Childhood, Adolescence and Adulthood.

PO3: To give knowledge to students about Physiopathological problems in this era.

PO4: To create awareness about Human Rights among the students.

### **Program Specific Outcome M.Sc. III sem Human Development**

PSO1: Paper IX - Principle of Guidance Counselling –

- Knowledge about various counseling therapies.
- How our students will give counselling according to Psycho disorders.
- Assessment of risk behaviour.

PSO2: Paper X – Advanced study in Human Development-

- To give knowledge to students regarding basic concepts of development.
- To educate the students regarding prenatal development, and also birth process.
- To create awareness about Personality development.

PSO3: Paper XI – Childhood Psychopathology-

- To teach the students about the effect of stress on physical and mental health.
- To teach the students symptoms of Psychopathological disorders, how to identify and the methods of treatment.
- To teach the students how to prevent our children from behaviour disorders.

PSO4: Paper XII – Child and Human Rights-

- To empower the girl students by giving the knowledge about Women's Rights.
- To develop awareness about the "Dowry Prohibition Act".
- To give knowledge about our fundamental civil rights.

### **Course Outcome M.Sc. III sem Human Development**

Paper IX- Guidance and Counselling

CO1: It explains the Meaning, Scope and Need of guidance and counseling for individuals, families and system.

CO2: To give knowledge to students about the Qualities and skills of counselor and explains the process of Counselling.

CO3: Guidance about Psychological disorders at different stages and Types of guidance.

CO4: The students can understand the basic concepts and facts about HIV/AIDS and Prevention of HIV infection.

CO5: To give knowledge of HIV/AIDS counseling and Assessment of risk behaviour.

#### Paper X: Advanced study on Human Development

CO1: It provides the knowledge about basic concepts of development(Maturation and learning) and Prenatal development.

CO2: It explains the development from birth to 2 years and also explains the social relationship during Infancy.

CO3: The students can understand the transition from Infancy to Childhood and the Importance of Early Childhood Education.

CO4: It explains the concepts about Puberty &Adoloscence and the emotional changes during adolescence

CO5: It gives the knowledge about Work & career development during middle adulthood 35 to 50 years. It also explains the Physical aspect of Ageing- Health and Disease.

#### Paper XI – Childhood Psychopathology

CO1: It explains the Criteria of Normality and Abnormality and the Meaning, need and importance of psycopathology.

CO2: It gives the knowledge about sources types and the effect of stress in psychological functioning.

CO3: It explains the Psychopathology of Neurotic disorders- Anxiety Neurosis, Phobia Neurosis and Obsessive Compulsive Neurosis.

CO4: To explain the students the Psychopathology of Psychotic disorders – Schizophrenia, Paranoia and Mood Disorders.

CO5: To give the knowledge about Psychopathology of Personality and Behaviour Disorders.

#### Paper XII: Child and Human Rights

CO1: To give knowledge about Fundamental Human Rights and what are the Child Rights to our students.

CO2: To explain the students about the problems of children with difficult circumstances – Child labour, street children and children of prostitutes.

CO3: To create awareness to our students about the status of women and their rights.

CO4: To give the students' knowledge about types of violation against women and crime against women.

CO5: To create awareness among the students about advocacy of Human Rights, Civil and Political Rights.

Practical Outcome – To develop ability to learn about the counseling process and to develop interaction ability with counselors and therapists.

### **Program Outcome M.Sc. IV sem Human Development**

PO1: For research purpose students should know various methods of studying Human Development in the subject.

PO2: To give knowledge to our students about various problems and characteristics of disabled persons and their education and rehabilitation.

PO3: The role of family in the development of personality along with socio-cultural studies of family pattern in India,

PO4: To give knowledge about community approaches and technologies.

### **Program Specific Outcome M.Sc. IVsem Human Development**

PSO1: Paper XIII – Methods of studying Human Development

- To teach the students about various methods for studying Human Development.
- To aware our students about some Psychometric methods for studying Psycho-Socio human behaviour.

PSO2: Paper XIV – Persons with Disabilities

- To teach the students various approaches to defining and understanding disabilities.
- To give knowledge about the policies and welfare program for disabled persons.

PSO3: Paper XV –Study of family in society

- To teach the students about family as a component of social system.
- To give knowledge about socio-cultural studies of family patterns in India.

PSO4: Paper XVI – Communication Technologies

- To aware our students about scope and approaches to communication.
- To guide them about the better and effective use of mass communication.

### **Course Outcome M.Sc. IVsem Human Development**

### **Paper XIII – Methods of studying Human Development**

CO1: To give knowledge to our students about different socio-cultural methods for data collection like survey methods like survey method, longitudinal and cross cultural.

CO2: Ability to develop in students to maintain the observation records and also skills of Report writing.

CO3: To prepare the students for various Interview techniques and protocols.

CO4: To develop the ability to prepare Questionnaire for data collection for Socio-Psychological problems.

CO5: To give knowledge about the administration of Psychometric tests for development of vocation efficiency and selection.

### **Paper XIV – Persons with Disabilities**

CO1: To teach the students the problems of orthopedically handicapped persons and also the education of physically challenged persons,

CO2: To give knowledge to students about various sensory impairments, characteristics and the provisions for rehabilitation.

CO3: To make the students aware about the diagnosis degrees of mental retardation and their treatment and education provisions.

CO4: To develop ability in our students to guide the parents of disabled children's along with to guide the education and rehabilitation centers of various places.

CO5: To encourage them for collecting such information's of disabled persons as a contributing member of society.

### **Paper XV – Study of family in society**

CO1: To give knowledge that the family is a dynamic institution and types of changes visualizing in family pattern.

CO2: To teach the students about the traditional, joint and extended families and also the causes and effects.

CO3: To give knowledge to students about the role of family in children's personality.

CO4: To teach our students regarding contemporary issues and concerns of family.

CO5: Teaching the girls various causes responsible for family disorganization and types of family tension.

### **Paper XVI – Communication Technologies**

CO1: To give knowledge about communication process and various approaches of communication.

CO2: To teach them elements of communication and communication technologies.

CO3: To create awareness regarding Innovation and Innovation adoption process.

CO4: To tell the students about the development of mass communication.

CO5: To give knowledge about designing and presentation using power point.

Practical methods – For research purpose students can select and use these methods under Psychotesting to assess human behaviour and for career guidance.

## **M.Sc. (Home-Science) Textile & Clothing**

### **Program Outcome M.Sc. (Home-Science) Textile & Clothing I sem**

PO1: Students will gain understanding of different textile materials.

PO2: To introduce the basic scientific concepts related to processing and production of textiles.

PO3: To understand fashion, fashion industries, retail marketing and merchandising.

PO4: To learn the elements of design and principle of colour theory and their application in clothing and accessories.

PO5: To understand the significance of research methodology in Home science and Social science research.

### **Program Specific Outcome M.Sc. (Home-Science) Textile & Clothing I sem**

PSO1: Paper I – Research Methodology

- To understand the types, tools, and methods of research and develop the ability to conduct data gathering instruments appropriate to the research design.
- To introduce what is research? And how it will be conducted in Home science and social sciences.
- To understand how to collect data and analysis of data for research report.

PSO2: Paper II – Textile Chemistry

- To understand the chemistry, production and fundamental properties of natural and synthetic fibers.
- To acquaint the students about the polymers, its types, processing's of which the textile fibers are made.
- To develop an understanding of the methods and techniques used to analyze textile fiber, yarns and fabric for end-use.
- To acquire knowledge and understanding of various structural properties of textiles and relate them to end fabric performance and product.

PSO3: Paper III – Fashion Retailing

- To understand the dynamics of fashion, role of fashion designers, and fashion industries.
- To gain knowledge about the management aspects of retailing and marketing.
- To develop understanding visual merchandising and its importance in today's consumer market.

PSO4: Paper IV – Textile Designing

- To develop awareness and appreciation of art and aesthetics in textiles.
- To impart creative and technical skills for designing textiles with special emphasis on structural design.
- The course aims at providing in-depth working – knowledge of line development and enables a student to use and practice skills and knowledge already acquired and use it to market situation.

#### Practical – Textile Chemistry

- To give practical knowledge of textile fibers, its identification, and chemical constitution to students.
- To give knowledge of fabric count, weaves and mechanical testing to students.

### **Course Outcome M.Sc. (Home-Science) Textile & Clothing I sem**

#### Paper I: Research Methodology

After completing the course the students will be able-

CO1: To learn role of research, types of research and conducting pilot surveys.

CO2: Knowledge of hypothesis, research problems and types of variables.

CO3: To develop concept about research design, data gathering and measuring instruments of reliability and validity.

CO4: Knowledge of theory of probability and sampling procedure.

CO5: To get knowledge of data tabulation, analysis, reports.

#### Paper II – Textile Chemistry

After completing the course the students will be able-

CO1: To know about fiber polymers, need of textile chemistry, characteristics of polymers etc.

CO2: To learn chemistry of cellulosic fibers and regenerated cellulosic fibers.

CO3: To study about protein fibers wool and silk.

CO4: To develop concept of synthetic fibers polyester, polyamide and acrylo nitrile.

CO5: To get knowledge of different natural and synthetic fibers and its blends with each other.

#### Paper III – Fashion Retailing

After completing the course the students will be able-

CO1: To gain knowledge about dynamics of fashion and National and International fashion designers.

CO2: To know the concept of retailing, planning and budgeting for a retail store.

CO3: To learn Elements and Principles of design, and its use in costume designing.

CO4: To learn how to sketch basic figures, fashion figures, and different action croaky.

CO5: Knowledge of visual merchandizing, types of display and plans and schedules for successful retailing.

#### Paper IV – Textile Designing

After completing the course the students will be able-

CO1: Knowledge of elements used in creating a design, colour composition in dress.

CO2: Knowledge related to structural and applied design, sources of inspiration and tools and equipment's used for textural effects.

CO3: To learn different components of fashion.

CO4: Acquaintance with motif its development, enlargement and reduction and combination for patterns.

CO5: Preparation of fabric for dyeing and printing and preparatory steps for different fibers at industrial level.

#### **Program Outcome M.Sc. (Home-Science) Textile & Clothing II sem**

PO1: To enable the students to acquire an in-depth understanding of the practical aspects and skills acquired during the course in the relevant subjects.

PO2: To understand the role of Statistics and Computer application in Research.

PO3: To acquaint the students with some advance textile technology.

PO4: To be able to analyze and interpret the result and predict the general textile testing.

#### **Program Specific Outcome M.Sc. (Home-Science) Textile & Clothing II sem**

PSO1: Paper V- Statistics and Computer Application

- To understand the significance of statistics and research methodology in Home Science.
- To understand and apply the appropriate statistical technique to the measurement scale and design.
- To apply statistical techniques to research data for analysis and interpreting data meaningfully.

PSO2: Paper VI - Quality Control in Textile

- To familiarize with the chemical processing from designing to finishing of textiles.
- To acquire knowledge and understanding of various structural properties of textiles and relate them to fabric performance and product.
- To familiarize students with the different testing equipment's.

PSO3: Paper VII - Fashion Illustration



- Focus on design details creation of styles and rendering techniques using the different media, pencils, pens, markers, charcoal, brushes, colours, papers.
- To develop understanding visual merchandising and its importance in today's consumer market.
- To gain knowledge about garments and garment details and accessories.

PSO4: Paper- VIII- Dyeing and Printing

- To impart the knowledge about preparation of fabric for Dyeing and Printing.
- To understand the theory of dyeing in relation to various classes of dyes
- To introduce the concept of dyeing at commercial level.

Practical: - Textile Designing

- Preparation of different types of knots in Tie and Dye.
- Preparation of fabric for printing and types of printing.
- To develop technical competency in dyeing and printing with different dyes on different fabrics.

### **Program Outcome M.Sc. (Home-Science) Textile & Clothing III sem**

PO1: To enable the students to understand and learn methods of developing fabrics using different fibers, yarn and fabric making techniques.

PO2: To gain knowledge and understanding of fundamentals of weaving, knitting machinery and processes.

PO3: to analyze different weave patterns and learn principles of creating design through weaving.

PO4: To understand technical textiles, medical textiles, and use of nano textiles in finishing.

### **Program Specific Outcome M.Sc. (Home-Science) Textile & Clothing III sem**

Paper IX – Fabric Construction

PSO1: To gain knowledge of process of weaving, knitting and non-woven process.

PSO2: To develop the skill with various techniques of styling and decoration on the fabric surface for value added fashion product like texturization.

PSO3: To enable the students to obtain perfect fit and harmony between the fabric and design of garments.

PSO4: To know modern developments in yarns at their manufacture and to know modern yarn productions.

### Paper -X- Apparel Design

PSO1: To develop and understand the principles of pattern making through flat pattern and draping.

PSO2: To create awareness of quality assurance norms and evaluating of quality in apparel.

PSO3: To know buying criteria for different fabrics.

PSO4: To learn about fitting

### Paper XI - Historic Textiles

PSO1: To understand the various embroideries of India their traditional techniques and applications.

PSO2: To access similarities and dissimilarities in different civilization in terms of fibre production, ornamentation and usage.

PSO3: To know Indian classical dance costumes and folk dance costumes.

PSO4: To know Historical textiles of special significance.

### Paper XII - Textile Industry

PSO1: To gain knowledge of Textile and Clothing industry, structure and functioning.

PSO2: Knowledge related to processes before, during and after production.

PSO3: To study SWOT analysis.

PSO4: Knowledge of marketing and business environment of India.

## **Course Outcome M.Sc. (Home-Science) Textile & Clothing III sem**

### Paper IX – Fabric Construction

After completion of the subject students will be able -

CO1-To learn about modern yarn production, yarn blending and different types of yarns.

CO2- Knowledge of texturing of yarns.

CO3- Significance of weaving and working of Handloom.

CO4- knowledge of knitting, knitting machines, felts, non-woven and laces

CO5-Learn about Technical textiles, medical textile and use of Nano technology in textile.

### Paper -X- Apparel Design

CO1-Detail knowledge about industrial machines for cutting fabric, sewing machines and sewing problems.

CO2- Acquaintance with materials such as:- Fabrics, threads, needles, and components such as seams, stitches.

CO3- Knowledge of methods of pattern making- Drafting, draping and flat pattern.

CO4- Layouts of different fabrics, commercial paper patterns and buying criteria for knits, silks, denims etc.

CO5- Study about readymade garments. Fitting problems and pattern corrections.

#### Paper XI - Historic Textiles

After completion of the subject students will be able-

CO1- To know about the embroideries of India.

CO2- To know classical dance costumes of India.

CO3- Knowledge related to folk dance costumes of India.

CO4- Knowledge about development of fibers and development of dyeing printing since ancient times.

CO5- Knowledge of carpets, tapestries, brocades, shawls etc.

#### Paper XII - Textile Industry

CO1- To learn merits and demerits of textile industry in India. And cooperation and cooperative societies.

CO2- To know the importance and role of textile industry in Indian economy.

CO3- Knowledge of National textile policies and different textile and Clothing industries.

CO4- Core concepts of marketing and merchandising.

CO5- To develop concept of SWOT analysis and business buying behaviour.

Practical outcome-

Fabric Construction and pattern making.

To understand dart manipulation for better garments.

Different types of sleeves and collars.

### **Program Outcome M.Sc. (Home-Science) Textile & Clothing IVsem**

PO1 - After completing fourth semester students are able to go for their higher studies. They can do MPhil, PhD, or engaged in any type of research fellowship.

PO2 - After getting master's degree in Textile and Clothing students are able to go for competitive exams like NET, SLET, Bed etc.

PO3- Students are able to become Textile Designer, fashion designer, free Lancer etc.

PO4 - Ability to become an Entrepreneur.

PO5- After completion of fourth semester students are able to apply knowledge in different domains like Textile Industry, Garment manufacturing unit, personal boutiques, education sector, fashion industry, accessories units etc.

### **Program Specific Outcome M.Sc. (Home-Science) Textile & Clothing IV sem**

PSO1 - To enable the students to understand and learn methods of developing fabrics using different fibres, yarn, and fabric making techniques.

PSO2 - To analyze different weaves, knits patterns and learn principles of creative design through weaving and knitting.

PSO3- To impart an in-depth knowledge of style readings, pattern making and garment construction techniques.

PSO4 - To develop and understand the principles of pattern making through the pattern and draping.

PSO5- To gain knowledge of the significance developments in production of textiles in the World.

PSO6- To develop sensitivity and understanding towards historic silhouettes and designs.

PSO7- Recognize and appreciate the design effects in textile masterpieces of the World.

PSO8- Knowledge of merchandising activities in a retail shop.

PSO9- knowledge of domestic and export markets.

PSO10- Understand the evolution of western costumes.

### **Course Outcome M.Sc. (Home-Science) Textile & Clothing IV sem**

#### **Paper XIII - Knitting Technology and Draping**

CO1- After studying subject student acquainted to types of looms, basic and decorative weaves.

CO2- Knowledge of textile design through weaving.

CO3- Knowledge of draping, dress form and developments of different ladies garments.

CO4- Study of one piece, two piece and dartless dresses and dart manipulation.

CO5- Draping of symmetrical and asymmetrical dresses and pattern markings, pattern envelopes, guide sheet etc.

#### **Paper IX - Apparel and Its Social, Psychological Aspects.**

CO1- It provides the knowledge of capes, hoods, built-up necklines, facings etc.

CO2- Knowledge of clothing for people with different physique, maternity and lactation period and old age

CO3- Knowledge of identification of components of apparel and standards for evaluating the various components.

CO4- Origin of clothing, socialization and development of self.

CO5- Knowledge of personality and personality theories.

#### **Paper XV Historic Costumes**

CO1- Origin and functions of clothing, sarees of different states and costumes of ancient civilizations.

CO2- History of Indian State costumes for male and female.

CO3- Knowledge of costumes for men and women during 10th to 17th century.

CO4-.Costumes of 18th to 20th century for different countries.

CO5- Growth of costumes, fashion terminologies, fashion forecasting and design development.

#### **Paper XVI - Fashion Merchandising**

CO1- After studying this subject students acquainted knowledge of market segmentation, targeting and positioning through various means

CO2- Knowledge of product and brand management and strategies.

CO3- Knowledge of sales promotion, advertisement, channels of distribution, and product life cycle.

CO4- Knowledge of necessary elements and principles for retail outlets.

CO5- Knowledge of visual merchandising. Knowledge of domestic and export marketing.

Practical outcome -

Development of paper patterns and construction of different garments.

Preparation of different traditional and fancy embroideries.

### **MASTER OF COMMERCE**

#### **M.Com. (Four Semesters) Regular Courses offered Programme Outcome (P.O.)**

PO1. After getting Master's Degree in Commerce students are able to develop an ability to apply knowledge in different domains like Banking Sector, Insurance Sector, Accounting field, Taxation Field, Marketing Field etc.

PO2. Ability to become an entrepreneur.

PO3. Ability to work in teams with enhanced interpersonal skills and communication.

PO4. Ability to develop Team work, Leadership, Managerial, Financial and Administrative Skills.

PO5. After getting Masters Degree in Commerce students are able to go for their higher studies they can do M.Phil, Ph.D. or engage in any type of research fellowship.

PO6. After getting Masters Degree in Commerce students are able to go for teaching field. They can appear in competitive exam like NET, SLET, B.Ed. etc.

PO7. After getting Master's Degree in Commerce students are able to go for professional courses like CMA/ CA/ CS/CFA.

PO8. After getting Master's degree students are able to work in Private and Public Companies as well as M.N.C.s.

#### **Programme Specific Outcome (PSO)**

PSO 1. It enables the students to study about Managerial perspective to Economic fundamentals as aids to Decision Making under given Environmental constraints.

PSO 2. It enables to students to study about Accounting issues and practise Maintenance of Company Accounts and handling accounting adjustments.

PSO3. It enables the students to understand the conceptual framework of Income Tax.

PSO4. It enables the students to study about application of statistical tools and techniques for decision making.

PSO5. It enables the students to study about relevant provisions of various laws influencing Business Operations.

PSO6. It enables to students to study about the application of Statistical tools and techniques for decision making.

PSO7 It enables the students to study about managerial perspective to economic fundamentals as aids to decision making under given environmental constraints.

PSO 8. It enables the students to study about specialised company accounts

PSO 9. It enables the students to study about Corporate Tax Planning and Indian tax law.

PSO10. It enables the students to study about relevant provisions of various laws influencing business operations.

PSO 11.It enables the students to study about conceptual framework of management and organisational behaviour.

PSO12. It enables the students to study about Concept and Tools used in Cost Accounting.

PSO 13.It enables the students to study about Accounting Concepts, Tools and techniques for Managerial Decisions.

PSO 14. It enables to students to study about conceptual framework of Financial Management, Personnel Management, production Management and Strategic Management.

## **COURSE OUTCOME**

### **M COM. 1<sup>st</sup> SEMESTER**

#### **Managerial Economics (PAPER- I)**

CO1. To provide the knowledge of Managerial Economics and Role and Responsibilities of Managerial Economist .

CO 2. To provide the knowledge of Fundamentals of Economic Concept.

CO 3. To provide the knowledge of Demand Analysis.

CO 4. To provide the knowledge Theory of Consumer Choice and Demand Forecasting.

CO 5. To provide the knowledge of Production Theory.

**Advanced Accounting (paper - ii)**

CO 1. It provides the practical knowledge of Issue , Forfeiture and Redemption Procedure of Shares and Debentures.

CO2. It provides the practical knowledge of Final Accounts and Financial Statements of Companies.

CO3. It provides the practical knowledge of Amalgamation and Reconstruction of Companies.

CO4. It provide the practical knowledge of Holding and Subsidiary Companies.

CO 5. It provides the practical knowledge of Liquidation of Companies

**Income Tax Law and Accounts ( paper - iii)**

Co1. It provides the practical knowledge of Law relating to Income Tax.

Co 2. It provides the practical knowledge of Calculation of Taxable Income under the Head Salary and House Property.

CO3 .It provides the practical knowledge of calculation of Taxable Income under the head Business and Profession, Capital Gains and Hindu Undivided Family. They also gain the knowledge of Depreciation and Development Allowances.

CO4. It provides the practical knowledge of Set-off and Carry Forward of Losses, Deduction from Gross Total Income, and Calculation of Taxable Income of an Individual and Hindu Undivided Families.

CO5. It provides the knowledge of Appeals & Revisions, Offence and Penalties Income Tax Authorities.

**Statistical Analysis (paper iv)**

CO 1. It provides the knowledge of Basic Concept of Statistics and Statistical Investigation, Classification and Tabulation.

CO 2. It provides the knowledge of Data Sources.

CO 3. It provides the knowledge of Dispersion, Co-efficient of Variance and Skewness, Correlation and Regression Analysis.

CO 4. It provides the knowledge of Probability Theory.

CO 5. It provides the knowledge of Probability Distribution Characteristics and Applications.

**Corporate Legal Framework (paper - v)**

CO 1. It provides the knowledge of Relevant Provision of Companies Act 2013.

CO 2. It provides the knowledge of Company Management, Managerial Remuneration, Winding up and Dissolution of Companies.

CO 3. It provides the knowledge of Negotiable Instrument Act 1881.

CO 4. It provides the knowledge of Presentation Endorsement, Crossing of Cheque and other Negotiable Instruments.

CO 5 .It provides the knowledge of Legal Environment for Security Markets.

### **M COM 2<sup>nd</sup> SEMESTER**

#### **Business Economics (paper- vi)**

CO 1. It provides the knowledge of Cost Theory and Law of Variable Proportions and Return to Scale.

CO2. It provides the knowledge of Price Determination under different market conditions.

CO3. It provides the knowledge of Pricing Practices.

CO4. It provides the knowledge of Business Cycle.

CO 5.It provides the knowledge of Inflation.

#### **Specialised Accounting (vii)**

CO1. It provides the Practical Accounting Knowledge of General Insurance Companies.

CO2. It provides the Practical Accounting Knowledge of Banking Companies.

CO3.It provides the practical Accounting knowledge of Public Utility Concern and Double Accounts System.

CO4. It provides the practical Accounting knowledge of Royalty Accounts.

CO5. It provides the practical Accounting knowledge of Investments.

#### **Tax planning and Management ( paper viii)**

CO1. It provides the practical knowledge of Calculation of Taxable Income and Tax of Firm and Companies.

CO2. It provides the practical knowledge of Return of Income, Expert and Emergency and Re-opening of Assessment.

CO 3. It provides the knowledge of Concept of Tax Planning.

CO 4 . It provides the knowledge of Tax Planning of different Capital Structure.

CO 5. It provides the Practical knowledge of Preparation of Income Tax Return,Computation of Income Tax, Tax Deduction at Source and Advance Payment of Tax.



### **Advance Statistics (paper ix)**

- CO1.It provides the practical knowledge of Statistical Decision Theory .
- CO2. It provides the Practical knowledge of Statistical Estimations And Testing.
- CO3. It provides the Practical knowledge of Association of Attributes.
- CO 4.It provides the Practical knowledge of Statistical Quality Control .
- CO 5.It provides the Practical knowledge of Interpolation and Extrapolation.

### **Business Laws (paper X)**

- CO1. It provides the knowledge of Organization, Objectives, Functions and Role of SEBI ACT - 1992.
- CO2. It provides the knowledge of MRTP ACT 1969.
- CO3. It provides the knowledge of Consumer Protection ACT 1986.
- CO 4. It provides the knowledge of Regulation and Management of FEMA ACT 1999.
- CO 5. It provides the knowledge of brief history of W.T.O.

## **M. Com. III Semester**

### **Management Concept (Paper I)**

- CO1.It provides the knowledge of schools of Management Thought.
- CO2. It provides the knowledge of Managerial Functions like Planning and Organizing.
- CO3. It provides the knowledge of Staffing; Directing; Coordinating Control.
- CO4. It provides the knowledge of Theories of Motivation.
- CO 5. It provides the knowledge of Group Dynamics and Team Development.

### **Organizational Behaviour (Paper – ii)**

- CO1. It provides the knowledge of concept of Organizational Behavior.
- CO2. It provides the knowledge of Concept, Styles and Theories of Leadership.
- CO3. It provides the knowledge of Basic Organizational Conflict.
- CO4. It provides the knowledge of Interpersonal and Organizational Communication.
- CO 5. It provides the knowledge of Basic Organizational Development.

### **Advanced Cost Accounting (Paper–iii)**

- CO1. It provides the knowledge of Cost Analysis and of Cost Control.
- CO2. It provides the knowledge of Determination of Labor cost.
- CO3. It provides the knowledge of Contract Costing and Operating Costing.

CO4. It provides the knowledge of Process Costing, Joint & By-Products.

CO 5. It provides the knowledge of Budgetary Control.

#### **Management Accounting (Paper–iv)**

CO1. It provides the knowledge of Introduction about Management Accounting.

CO2. It provides the knowledge of Accounting Plan and Responsibility Centers.

CO3. It provides the knowledge & Practice of Budgeting.

CO4. It provides the knowledge of Standard Costing and Variance Analysis.

CO 5. It provides the knowledge of Basic concept of Marginal Costing.

#### **Accounting for Managerial Decisions (Paper–v)**

CO1. It provides the knowledge of Break-Even-Analysis.

CO2. It provides the knowledge of Analyzing Financial Statements.

CO3. It provides the knowledge of Cash Flow Analysis and Fund Flow Analysis.

CO4. It provides the knowledge of Contemporary Issues in Management Accounting.

CO 5. It provides the knowledge of Reporting to Management.

### **M. Com. Fourth Semester Optional group –B**

#### **Financial Management (Paper: B -I)**

CO1. It provides the knowledge of Financial Management &Capital Budgeting.

CO2. It provides the practical knowledge of Cost of Capital .

CO3. It provides the practical knowledge of Operating and Financial Leverage  
& Capital Structure Theories.

CO4. It provides the knowledge of Dividend Policies.

CO 5. It provides the knowledge of Management of Working Capital.

#### **Personnel Management (Paper: B – Second)**

CO1. It provides the knowledge of Basic Concept of Personnel Management.

CO2. It provides the knowledge of Personnel Policies, Programmes & Procedures.

CO3. It provides the knowledge of Man Power planning, Training & Development of Employees & Executives.

CO4. It provides the knowledge of Performance Appraisal of employees and the Techniques of Job Evaluation etc.

CO 5. It provides the knowledge of Employees Fringe Benefits & Services .

### **Production Management (Paper: B – iii)**

CO1. It provides the knowledge of Fundamentals of Production Management.

CO2. It provides the knowledge of Production Planning.

CO3. It provides the knowledge of Process Design & Factors affecting Design.

CO4. It provides the knowledge of Work Measurement and Work Standards.

CO 5. It provides the knowledge of Production Control.

### **Strategic Management (Paper: B – iv)**

CO1. It provides the knowledge of Concept of Strategy & Environmental Analysis and Diagnosis.

CO2. It provides the knowledge of Strategy Formulation and Choice of Alternatives.

CO3. It provides the knowledge of Functional Strategies.

CO 4. It provides the knowledge of Strategy Implementation and Strategy and Structure.

CO 5. It provides the knowledge of Strategy Evaluation.

### **Project Work**

CO1. After completion of the course, students will have the knowledge of Concept of Research and Research Methodology.

CO2. It provides the knowledge of Data Analysis and Their Interpretation.

CO3. It provides the knowledge regarding Finding the Research Problem and Preparation of Research Design.

CO4. It provides the knowledge of Writing Research Papers.

CO 5. It provides the knowledge regarding the Application of Quantitative Research Methods.



