Rajkiya Mahavidyalaya Kanvaghati Kotdwar (Pauri Garhwal)
Programme Outcome – B.Sc.

PHYSICS PROGRAMME SPECIFIC OUTCOMES:

This undergraduate course in Physics would provide the opportunity to the students:

1- To understand the basic laws and explore the fundamental concepts of physics
2- To understand the concepts and significance of the various physical phenomena.
3- To carry out experiments to understand the laws and concepts of Physics.
4- To apply the theories learnt and the skills acquired to solve real time problems.
5- To acquire a wide range of problem solving skills, both analytical and technical and to apply them.
6- To enhance the student's academic abilities, personal qualities and transferable skills this will give them an opportunity to develop as responsible citizens.
7- To produce graduates who excel in the competencies and values required for leadership to serve a rapidly evolving global community.
8- To motivate the students to pursue PG courses in reputed institutions.
9- This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques specially the importance of accuracy of measurements.
10- Providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, heat, optics, electricity and electronics.

B. Sc. PHYSICS Course Outcomes:

Outcomes of Physics Paper: Mechanics

1- The students would learn about the behavior of physical bodies.
2- It provides the basic concepts related to the motion of all the objects around us in our daily life.
3- The course builds a foundation of various applied field in science and technology; especially in the field of mechanical engineering.
4- The course comprises of the study vectors, laws of motion, momentum, energy, rotational motion, gravitation, fluids, elasticity and special relativity.
5- Understand the physical interpretation of gradient, divergence and curl.
6- Study of gravitational field and potential and understanding of Kepler's laws of Planetary motion.
7- Understanding of different frames of references and conservation laws.
8- Understand the dynamics of rigid body and concept of moment of inertia
9- Study of moment of inertia of different bodies and its applications.
10- Study the properties of matter, response of the classical systems to external forces and their elastic deformation and its applications.

11- Comprehend the dynamics of Fluid and concept of viscosity and surface tension along with its applications.
12- Study of superposition of harmonic oscillations, waves motion (general), oscillators, sound, wave optics, interference, diffraction, polarization.

Outcomes of Physics Paper: Electricity and Magnetism

1- It gives an opportunity for the students to learn about one of the fundamental interactions of electricity and magnetism, both as separate phenomena and as a singular electromagnetic force.
2- The course contains electrostatics, magnetism, electromagnetic induction and Maxwell's equations.
3- The course is very useful for the students in almost every branch of science and engineering.
4- Evaluation of Electric field and potential for different types of charge distribution.
5- Understand the concept of polarizability, Magnetization and Electric Displacement Vector.
6- Study of Steady and Varying electric currents.
7- Understanding of different aspects of alternating currents and its applications.
8- Understand the Magnetostatics, Lorentz Force and Energy stored in magnetic Field.
9- Comprehend the different aspects of Electromagnetic induction and its applications.

Outcomes of Physics Paper: Wave and Oscillations

1- The course comprises of the study of superposition of harmonic oscillations, waves motion (general), oscillators, sound, wave optics, interference, diffraction, polarization.
2- The course is important for the students to make their career in various branches of science and engineering, especially in the field of photonic engineering.

Outcomes of Physics Paper: Thermal Physics and Statistical Mechanics

1- The course makes the students able to understand the basic physics of heat and temperature and their relation with energy, work, radiation and matter.
2- The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work.
3- The course contains the study of laws of thermodynamics, thermodynamic description of systems, thermodynamic potentials, kinetic theory of gases, theory of radiation and statistical mechanics.
4- Recognize the difference between reversible and irreversible processes.
5- Understand First and Second Law of Thermodynamics and concept of Entropy.
6- Understand the physical significance of thermodynamical potentials.
7- Comprehend the kinetic model of gases w.r.t. various gas laws.
8- Study the implementations and limitations of fundamental radiation laws.

Outcomes of Physics Paper: Optics

1- Study of Interference of light. Interference by division of wavefront and division of amplitude.
2- Understanding Diffraction of Light and concept of Zone Plate.
3- Understand the polarization of light..
4- Study of different types of associated optical instruments based on interference and diffraction of light which are widely used in industry and research.
5- They would also learn optical phenomena such as polarisation and dispersion and experimental explanation related to optical devices: Prism, grating, spectrometers.
6- Study of Fermat's Principle of Extremum Path and understands fundamental physics behind reflection and refraction of light.
7- Understand the theory of image formation by an optical system.
8- Study of different types of optical Aberrations and techniques for their reduction.
9- Study of different types of optical instruments used in industry and research

Outcomes of Physics Paper: Solid State Physics

1- Students would be able to understand various types of crystal structures and symmetries and understand the relationship between the real and reciprocal space.
2- Students would be learn the Bragg's X-ray diffraction in crystals.
3- Students Would also learn about phonons and lattice.
4- Study of hydrogen spectra and X- rays.
5- Understanding fundamentals of molecular spectroscopy.

Outcomes of Physics Paper: Quantum Mechanics

1- Quantum mechanics provides a platform for the physicists to describe the behaviour of matter and energy at atomic and subatomic level.
2- The course plays a fundamental role in explaining how things happen beyond our normal observations.
3- The course includes the study of Schrodinger equations, particle in one dimension potential, quantum theory of H like atoms, atoms/molecules in electric and magnetic fields.

Outcomes of Physics Paper: Elements of Modern Physics

1- Students would know about the basic principles in the development of modern physics.
2- The topics covered in the course build a basic foundation of undergraduate physics students to study the advance branches: quantum physics, nuclear physics, particle physics and high energy physics.
3- The course contains the study of Planck's hypothesis, photoelectric effect, Compton effect, matter waves, atomic models, Schrodinger wave equations, and brief idea of nuclear physics.

4- Study of different atomic models.
5- Study of spectra and X- rays.
6- Understand the theory of LASERS which are widely used in industry and research.
7- Study of structure of atomic nucleus and radioactive decay.
8- Study of Elementary Particle Physics.

Outcomes of Physics Paper: Basic Concepts of Electronics

1- The students would gain the knowledge of Basic Electronics circuits, network theorems and measuring instruments:
2- Study of different types of special diodes and their applications.
3- Study of Transistors and their different types.
4- The topics also include the Rectifiers, Filters and their applications, number systems and logic gates which are foundation blocks of digital electronics.
5- Students would learn about electronic circuits such as Amplifiers and Oscillators.
6- Various types of Amplifier and Oscillator circuits their working and applications in in domestic, industrial and scientific devices/equipments.
7- Study of feedback in amplifiers along with their advantages and disadvantages.
8- Understand the concepts of Boolean Algebra and various number systems.
9- Study of logic gates and their applications.

Outcomes of Physics Lab Course:

1- Students would perform basic experiments related to mechanics and also get familiar with various measuring instruments would learn the importance of accuracy of measurements.
2- Measurement precision and perfection is achieved through Lab Experiments.
3- Students would gain practical knowledge about electricity and magnetism and measurements such as: Resistance, Voltage, current etc.
4- The instruments are used to study and determine the electric and magnetic properties.
5- Students would gain practical knowledge about heat and radiation, thermodynamics.
6- The practical knowledge of wave motion doing experiments: Tuning fork, electric vibrations.
7- Students would be able to understand Basic experiments of modern physics such as: Determination of Plank's constants.
8- Students would be able to understand various characteristics of diodes and transistors.
9- Students also learn the concepts of logical gates and circuits.

PROGRAMME OUTCOMES- CHEMISTRY

After completion of B.Sc chemistry programme students will be able to:

PO 1. Students will have a strong foundation in the fundamentals and applications of chemical andscientific theories including inorganic, organic and physical chemistry.

PO 2. Students will be able to carry out scientific experiments as well as accurately recordand analyze the data of such experiments.

PO 3. Students will develop skill in problem solving, critical thinking and analytical reasoning asapplied to scientific problems.

PO 4. Students will be able to explore new areas of research in both chemistry and allied fields of chemistry.

PO 5. Students will appreciate the central role of chemistry in our society and use this as basis forethical behaviour in issues facing chemists including an understanding of safe handling ofchemicals, environmental issues and key issues facing our society in energy, health andmedicine.

PO 6. Students will be able to explain why chemistry is an integral activity for addressing social,economic, and environmental problems.

PO 7. Students will be able to function as a member of an interdisciplinary problem-solving team.

Course Outcomes Of B.Sc 1st Chemistry

Course	Course Outcomes
(Inorganic Chemistry)	**CO-1:** To know different criteria for structures of atom. **CO-2:** To know periodic properties such as ionization energy, electron affinity and predicting and explaining the chemical behavior. **CO-3**: To learn the concepts of chemical bonding theories and explain the geometry and hybridization of molecules. **CO-4:** To know and study of periodic table with different elemental properties and also understand the properties of noble gases.

(Organic Chemistry)	**CO-1:** Current bonding models for organic molecules in order to predict structures and important bonding parameters. **CO-2:** It describes reactive intermediates transition states and states of all bonds broken and formed. To understand mechanistically approach of organic reactions. **CO-3:** The chapter stereochemistry gives the clear picture of 2D and 3D structures of molecules and their roles in mechanism. It enables to understand the reactants catalyst, stereochemistry of major & minor products of any organic reactions. **CO-4:** Upon successful completion of the course the students will be able to describe the reactions shown by aliphatic and aromatic compounds.
(Physical Chemistry)	**CO-1:** The course will strengthen the knowledge for student regarding complete picture of states of matter that includes gaseous, liquid, solid and colloidal states. **CO-2:** Students will be able to describe the different aspects of chemical kinetics and catalysis. Determination of the order of reaction and experimental methods of chemical kinetics.
(Laboratory Practical)	**CO-1:** Upon completion of this course the students will have the knowledge and skills to understands the laboratory methods and test related to inorganic mixture analysis and determination the percentage composition of given binary mixture by surface tension methods. **CO-2:** The students will also able to determine the melting points and boiling points of some organic and inorganic coumpounds experimentally.
Course	**B.Sc. Second Year (Chemistry)**
(Inorganic Chemistry)	**CO-1:** To know the chemistry of first, second and third Transition series and characteristics properties of d-block elements. **CO-2:** After successful completion of this course the students will be able to gather the information regarding Werner's theory and VBT of transition metal complexes. **CO-3:** Students will be able to learn chemistry of Lanthanides and Actinides and their chemical approach. **CO-4:** Students will be able to define the acids and

	bases on the basis of various concepts/theories and will be able to Solve the problems related acids and bases reactions.
(Organic Chemistry)	COURSE OUTCOMES: This paper provides detailed knowledge of synthesis of aldehydes and ketones, carboxylic acids and functional groups inter conversions students will be able to define electromagnetic spectra and also able to gain some practical knowledge related UV and IR spectroscopy.
(Physical Chemistry)	COURSE OUTCOMES: After successful completion of this course the students will be able to gather the good knowledge of thermodynamics, basic concepts of spontaneity chemical and phase equilibrium and able to apply these concepts in predicting the different types of reactions and will be able to solve related problems. ✓ To learn in detail about the first and second laws of chemical thermodynamics relationships. ✓ To gain vast knowledge of chemical equilibrium and electrochemistry.
(Laboratory Practical)	COURSE OUTCOMES: After completion of this course the students will have the knowledge and skills to understand the laboratory methods and they will also learn about quantitative analysis in terms of volumetric analysis and also they are able to estimate hardness of water by EDTA method. ✓ Students will able to learn different chromatographic techniques like paper and TLC. ✓ They will also able to do qualitative analysis as identification of organic compounds through the functional group which is helpful to work in the industry. ✓ students will also able to calculate heat of neutralization of an weak acid/base experimentally.
Paper	**B.Sc. Third Year (Chemistry)**
(Organic Chemistry)	COURSE OUTCOMES: Upon successful completion of this course. The students will be able to describe the stability crystal field theory (CFT) and electronic spectra and Magnetic properties of

	coordination compounds. They will also learn about organo - metallic compounds and some industrially important inorganic materials and their applications in various industries. It will assist them to get a suitable job in the relevant industrial and scientific field.
(Organic Chemistry)	COURSE OUTCOMES: After successful completion of this course the students should be able to understand the NMR spectroscopic techniques and their role in the different industrial and research field. They are also able to understand of the chemistry of organic compounds which are applicable in the various fields of industrially important materials such as lipids, fats, soaps, oils detergents, dyes, paints and polymer like PVC and synthetic rubber. upon completion of this course student may get job opportunities in above related fields.
(Physical Chemistry)	COURSE OUTCOMES : After completion of this course the students will able to understand basic knowledge of rotational, vibration and Raman spectrum which will help them to understand the higher chemistry in PG classes. Their understanding of photo chemistry and solutions will help them to explain the day today phenomenon of the relevant field whereas, learning the quantum mechanics will help them to praise the beauty of behavior of fundamental particles. It will assist them to get a suitable job in the relevant industrial and scientific field.
(Laboratory Practical)	COURSE OUTCOMES : After completion of this course the students will have the knowledge to understand the laboratory methods. Students will also able to get good practical knowledge and tests of some instrumental techniques and laboratory technique of steam distillation students will able to get job opportunities by these echniques. ✓ To understand the various inorganic and organic preparations. ✓ They will able to learn in the fields of experiments of physical chemistry such as electro chemistry refractrometry.

Programme Name: B. Sc .(Mathematics)

❖ For this program the students should be able to recall basic facts about Mathematics and display knowledge of conventions such as notations, terminology etc.

❖ For this program the students should be able to think in a critical manner and develop problem solving skills.

Program Outcome

❖ This program gives in depth knowledge of matrices, trigonometry, calculus, geometry, algebra, differential equations, real analysis, complex analysis, vector analysis, numerical analysis, linear algebra and several other branches of pure and applied Mathematics.

❖ This program helps the students to formulate and develop mathematical arguments in a logical manner.

❖ This program also leads to study' the related areas such as Computer science and other allied subjects.

❖ The skills and knowledge gained in this programme will be helpful for modeling and solving of real life problems.

❖ This program enhanced quantitative skills and pursuing higher Mathematics and research as well.

❖ This program also leads to students to apply their skills and knowledge in various fields of studies including science, engineering, commerce, management etc.

❖ This program motivates the students to prepare for research studies in Mathematics and related fields.

❖ The completion of this program will enable the learner to use appropriate digital programs and software to solve various mathematical problems.

❖ After completing this program the students will become employable in various government and private sector.

Course Title: Matrices¸ Trigonometry and Differential Calculus
Course Code: UGMAT101T
B.Sc. (Mathematics) I Semester (Paper-I)

After successful completing this course the students will be able to

- ❖ Understand the concept of matrix and matrix operations with their properties.
- ❖ Know about the different type of matrices.
- ❖ Find the rank of a matrix, rank of sum and product of two matrices.
- ❖ Find the inverse of a non-singular matrix through elementary row transformations.
- ❖ Solve the system of linear homogeneous equations.
- ❖ Solve the system of linear non-holl1ogeneous equations.
- ❖ Understand the Trigonometric functions or circular functions and their inverses.
- ❖ Understand the Hyperbolic functions and their inverses.
- ❖ Know the relationship between Trigonometric and Hyperbolic functions.
- ❖ Understand the Exponential functions and Logarithmic functions.
- ❖ Understand the concept of Euler's theorem.
- ❖ Understand the concept of Gregory's series.
- ❖ Understand the concepts of limit, continuity and differentiability.
- ❖ Understand the Jacobians.
- ❖ Understand the maxima and minima of single variable function.
- ❖ Understand the Rolle's theorem, Mean value theorems and their applications.
- ❖ Understand the successive differentiation and n^{th} differential coefficient of functions.
- ❖ Understand the Taylor's theorem, Maclaurin's theorem, Taylor's and Maclaurin's series expansions.
- ❖ Understand the concepts of tangents, normals, sub-tangents, sub-normals.
- ❖ Understand the concept of curvature and methods of finding curvature.
- ❖ Understand the concept of asymptote and methods of finding asymptote.
- ❖ Understand the concepts of singular points and points of inflexion.

Course Title : Practical

Course Code: <u>UGMAT102P</u>

B.Sc.(Mathematics) Ist Semester (Paner-11)

Course Outcome

After successful completing this course the students will be able to

- ❖ Understand the different computer softwares such as Mathematics / MATLAB / Maple/ Scilab *I* Maxima etc.
- ❖ Compute the operations of addition, subtraction and multiplication of matrices by using different computer software.
- ❖ Compute the trace, transpose and rank of n matrix by using different computer software.
- ❖ Compute the inverse of n matrix by using different computer software.
- ❖ Solve the system of homogeneous and non-homogeneous linear algebraic equations.
- ❖ Obtain the nth order derivative of exponential, trigonometric and hyperbolic functions by using different computer software.
- ❖ Obtain the nth order derivative of algebraic and logarithmic functions by using different computer softwares.
- ❖ Obtain the Taylor's and Maclnurin's expansions of the given functions by using different computer software.

Course Title : Inte2ral Calculus and Vector Analysis
Course Code : UGMAT201T

B.Sc. (Mathematics) IInd Semester (Paper-I)

Course Outcome

After successful completing this course the students will be able to

- ❖ Understand the integral as a limit of sum and properties of definite integrals.

  Know the fundamental theorem of integral calculus.
- ❖ Find the summation of series by integration.
- ❖ Understand the concept of infinite integrals.
- ❖ Know the differentiation and integration under integral sign.
- ❖ Know about Beta functions, Gamma functions,
- ❖ Know about the properties of Beta and Gamma functions, relation between Beta and

Gamma functions.

- ❖ Evaluate the integrals using Beta and Gamma functions.
- ❖ Know about Double integrals, Repeated integrals, Triple integrals,
- ❖ Understand the evaluation of Double integrals and the evaluation of Triple integrals.
- ❖ Know about the change of order of integration in double integrals.
- ❖ Find the area bounded by curves (Quadrature).
- ❖ Find the length of curves (Rectification).
- ❖ Find the Volume and surface area of solid of revolution.
- ❖ Know the triple product, reciprocal vectors, product of four vectors.
- ❖ Understand the general equation of a plane, Normal and intercept forms of a plane,
- ❖ Understand the concepts of direction cosines and direction ratios of a line.
- ❖ Understand the equation of a line and its symmetrical and unsymmetrical forms.
- ❖ Understand the concepts of coplanar lines, lines of shortest distance.
- ❖ Understand the intersection of three planes.
- ❖ Understand the concept of ordinary differentiation of vectors.
- ❖ Understand the Differential operator-Del, Gradient, Divergent and Curl.
- ❖ Understand the Line integrals, Surface integrals and Volume integrals.
- ❖ Know the applications of Gauss divergence theorem, Green's theorem and Stokes theorem.

Course Title :   **Differential Equations**

Course Code :   BM 201

B.Sc. {Mathematics) 2nd Year (Paper-I)

Course Outcome

After successful completing this course the students will be able

- ❖ Understand the concept of order and degree of a differential equation.
- ❖ Solve the differential equations of first order and first degree.
- ❖ Solve the differential equations of first order but not of first degree.
- ❖ Understand the general theory of differential equations.
- ❖ Understand the concept of Wronskian and its properties.
- ❖ Solve the linear differential equations with constant coefficients.

- ❖ Understand the method of variation of parameters.
- ❖ Solve the simultaneous ordinary differential equations.
- ❖ Solve the homogeneous differential equations (Cauchy-Euler equation).
- ❖ Solve the linear differential equations of second order with variable coefficients.
- ❖ Solve total differential equations.
- ❖ Understand the concept of order and degree of a partial differential equation.
- ❖ Understand the concept of linear and non-linear partial differential equation.
- ❖ Formulate first order partial differential equation.
- ❖ Solve the linear partial differential equation of first order.
- ❖ Understand Lagrange's method and Charpit's method.

Course Title : **Differential Equation**

Course Code :**BM 202**

B.Sc. {Mathematics) IInd Year (Paper-II)

Course Outcome

After successful completing this course the students will bo able

- ❖ Understand the Real numbers end their properties.
- ❖ Understand the concept of Real line, Supremum, infimum.
- ❖ Understand completeness property and Archimedean property.
- ❖ Understand and explain Finite and infinite sets, Bounded sets, countable and uncountable sets.
- ❖ Understand the real sequences, bounded sequences
- ❖ Understand and explain Cauchy convergence criterion for sequences.
- ❖ Understand Cauchy's theorem on limits.
- ❖ Understand order preservation and squeeze theorem,
- ❖ Understand the concept of Monotone sequences and their convergence.
- ❖ Have an idea about Bolzano-Weierstrass theorem and Monotone convergence theorem.
- ❖ Understand the concept of infinite series, positive term series, geometric series, alternating series etc.
- ❖ Understand Cauchy convergence criterion for series.
- ❖ Know about the convergence of p-series.
- ❖ Understand and explain comparison test, root test, ratio tst, Leibnitz's test etc.

- ❖ Define and explain absolute and conditional convergence.
- ❖ Understand and explain Rolle's theorem and mean value theorems.
- ❖ Understand and explain Taylor's theorem with Lagrange's and Cauchy's fonns of remainder.
- ❖ Understand the concept of Taylor's series and Maclaurin's series.
- ❖ Understand the concepts of the sequences and series of functions.
- ❖ Understand the concepts of point-wise convergence and uniform convergence.
- ❖ Understand the concepts of integrability and differentiability of functions.
- ❖ Understand the concepts of the power series and radius of convergence.

Course Title :   **Advanced AI2ebra**

Course Code :   **BM 203**

B.Sc. {Mathematics} IInd Year (Paner-III)

Course Outcome

After successful completing this course the students will be able to

- ❖ Understand Cayley's theorem.
- ❖ Understand Normal sub-group and their progenies, simple group. Center of 1t group. Understand the concept of Rings and their properties..
- ❖ Understand and explain various types of Rings. subrings.
- ❖ Understand the concept of ideals and different type of ideals.
- ❖ Explain the concept of principal ideal ring, quotient ring and ch3.r3ctcristics of a ring. Define integral domain, field, skew field.

Course Title : Linear Algebra and Linear programming Problems

Course Code : BM 301

B.Sc. (Mathematics) IIIrd Year (Paper-I)

Course Outcome

After successful completing this course the students will be able to

- ❖ Understand the vector spaces, sub-spaces nod algebra of sub-spaces.
- ❖ Understand the concept of linear combination of vectors, linear span

- ❖ . Understand the concept of linear independence, basis and dimension.
- ❖ Understand the concept of quotient spaces.
- ❖ Understand and explain the matrix representation of a linear transformation .
- ❖ Understand the algebra of linear transfom1ntion.
- ❖ Understand the concept of Eigen values and Eigen vectors.
- ❖ Understand the concept of linear functional, dual space and dual basis.
- ❖ Understand the concept of isomorphism and invertibility.
- ❖ Understand the concept of quotient spaces.
- ❖ Formulate linear programming problems and solve linear programming problems by graphical approach.
- ❖ Solve linear programming problems by simplex method and revised simple method.
- ❖ Understand the concept of artificial variables.
- ❖ Solve liner programming problems by two phase method, Big-M method etc.
- ❖ Define and explain the concepts of optimality, unboundedness and duality.
- ❖ Explain the formulation of the dual problem

Course Title : Complex Analysis

Course Title : BM 302

B.Sc. (Mathematics) IIIrd Year (Paper-II)

Course Outcome

After successful completing this course the students will be able to

- ❖ Understand the Complex numbers and their properties.
- ❖ Understand the geometrical representation of complex numbers.
- ❖ Know about trigonometrically and hyperbolic complex functions.
- ❖ Understand the analytic functions, Cauchy-Riemann equations, harmonic functions.
- ❖ Understand the zeros and singularities of analytic functions.
- ❖ Understand the concept of conformal mapping and its geometrical representation.
- ❖ Understand the theorems on conformal mapping.
- ❖ Understand the concept of Bilinear transformations and some special Bilinear

transformations.

❖ Understand the Fixed point and normal form of Bilinear transformations.

❖ Know about complex integration, Cauchy's theorem, poles.

❖ Know about Cauchy's integral formula, Cauchy's integral formula for the

❖ Derivatives of analytic functions, Morera's theorem.

❖ Understand the Cauchy's inequality.

❖ Understand the Taylor's theorem and Liouville's theorem.

❖ Understand the Taylor's series and Laurent's series.

Course Title : Numerical Analysis

Course Code: BM 303

B.Sc (Mathematics) IIIrd Year (Paper-III)

Course Outcome

After successful completing this course the students will be able to

❖ Understand the concepts of finite differences, difference operators, factorial notation.

❖ Know about interpolation with equal integrals.

❖ Know about interpolation with unequal intervals.

❖ Know about divided differences, central differences.

❖ Apply Newton's forward interpolation formula, Newton 's backward

   interpolation formula, Stirling formula. Bessel formula etc.

❖ now about numerical differentiation and integration.

❖ Apply Simpson's 1/3 rule, Simpson's 3/ 8 rule, Weddle's rule, Trapezoidal rule etc.

❖ Understand the numerical solution of algebraic and transcendental equations.

❖ Apply iteralive method, bisection .method. Regula Falsi method, Newton Raphson

❖ Method, Graeffe method etc.

❖ Understand the numerical solution of differential equations.

❖ Apply Picard's method, Euler method, Modified Euler method, Runga-Kutta method etc.

Programme Outcomes- Zoology

After completing B. Sc. Zoology programme students will be able to:

- ❖ PO1:   Demonstrate and apply the fundamental knowledge of the basic principles of major fields of Zoology.

- ❖ PO2: Apply knowledge to solve the issues related to animal science.

- ❖ PO3: Take appropriate steps towards conservation of endemic and endangered animal species.

- ❖ 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.

- ❖ PO7: To identify the concepts about various applied sciences and medical laboratory techniques related to concerned area.

Course Outcomes, B.Sc. I year Zoology

01- ANIMAL DIVERSITY - NON-CHORDATES
After successfully completing this course, students will be able to:

- ➢ Students will have learning about the basic taxonomy and systematics and classification of Protozoa, Porifera, Cnidarian and Helminth groups.
- ➢ They also will acquire knowledge about the biology of these taxonomic categories as well as about some acoelomate and pseudo coelomate.
- ➢ To understand the differences and similarities in the various aspects of classification.
- ➢ To classify invertebrate and to be able to understand the possible group of the invertebrate observed in nature.

02-CELL BIOLOGY AND GENETICS

After successfully completing this course, students will be able to:

➢ Students will understand the structures, positions and functions of plasma membrane and all cellular organelles in details.

➢ The students understand the importance of cell as a structural and functional unit of life.

➢ They will acquire knowledge about chromosomes and cell divisions, both mitosis and meiosis. Explain DNA structure and concept of mutation.

➢ They will also know about cell signalling and cancers.

➢ They will know how to measure and stain different cell types.

➢ Students will learn the fundamental genetics like Mendelian and Non-Mendelian inheritances, linkages, mutations, sex determination of various animals, extrachromosomal inheritances and genetic elements etc.

03-TAXONOMY, EVOLUTION AND BIOSTATISTICS

After successfully completing this course, students will be able to:

➢ Students will understand the basic term of in taxonomy and component of classification.

➢ Students will understand the general taxonomic rules on animal classification,

In addition, identify the new species

➢ Students will know about population genetics, human evolution, various concepts about origin of species, extinctions, phylogenetic tree making.

➢ Students will learn the fundamental evolutionary theories like Lamarckism, Darwinism and Neo-Darwinism.

➢ They will also understand the various aspects of biostatistics such as central tendency, t-test, chi-square, ANOVA, correlations and regression.

Course Outcomes, B.Sc. II year Zoology

01- ANIMAL DIVERSITY - CHORDATES

After successfully completing this course, students will be able to:

➢ Students will understand the classification, structure, function and biology of chordates of different taxonomic classes.

➢ They will also learn some special topics like zoogeography, metamorphosis, and snake bites, Venom and antivenin migration of birds, parental care of amphibian, Aerial and aquatic adaptation of mammals, poultry managements and different breeds of domestic.

02- ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

After successfully completing this course, students will be able to:

- Students will understand the physiological process in mammals.
- They will also understand the physiology of heart, muscles, nerves, digestive, respiration, blood circulation, excretion and reproductive systems etc.
- Students will understand the basic and fundamental biochemistry of carbohydrates, proteins, lipids and nucleic acids.
- They will also understand the nature, mechanism, and kinetics of enzyme action.
- They will also correlate the changes in the levels of these biomolecules with the diseases in human.

03- MOLECULAR BIOLOGY, MICROBIOLOGY AND BIOTECHNOLOGY

After successfully completing this course, students will be able to:

- Students will acquire knowledge about replication, transcription, translation, post transcriptional and post translational modifications, gene regulation, DNA repair mechanisms and various molecular tools and techniques like PCR, southern, northern and western blotting, recombinant DNA technology etc.
- They will also know the various tools and techniques related to bacterial microbiology.
- The students will also learn some aspects of applied microbiology and diseases related to microbiology.
- They will also understand the structure, classification, nutrition and reproduction of Bacteria.

Course Outcomes, B.Sc. III year Zoology

01- ENDOCRINOLOGY AND APPLIED ZOOLOGY

After successfully completing this course, students will be able to:

- Students will learn about function and mechanism of action of hormone.
- They will learn details of endocrinology with classification of hormones, their biosynthesis, receptors, mode of molecular actions, physiological function, feedback controls and related disorders
- They will understand about different vector borne diseases and the related life cycles, epidemiology, pathology, diagnosis, symptoms and treatments.
- They will also know the basics of sericulture, apiculture, aquaculture and

lac culture.

- ➢ They will also have knowledge about the basics of parasitology such as origin and evolution of parasitism, role of vectors, parasitism, host-parasite interactions etc.

02- ECOLOGY, CONSERVATION BIOLOGY & ANIMAL BEHAVIOUR

After successfully completing this course, students will be able to:

- ➢ Students will understand the various features and aspects of population ecology, community ecology and ecosystem ecology.
- ➢ They will acquire knowledge about various tools and techniques of field ecology.
- ➢ Student will be learning the various issues related to biodiversity loss and conservation as well as status, conditions and conservation of forests and wildlife.
- ➢ Students will know about in details patterns of behaviours, survival strategies, social and cooperative behaviours, design of signals and chronobiology.
- ➢ They will also know to biological rhythms, biological clock, circadian rhythms and photoperiodism.

03- DEVELOPMENTAL BIOLOGY AND TOXICOLOGY

After successfully completing this course, students will be able to:

- ➢ Students will learn the different aspects of early, late and postembryonic developments.
- ➢ They will have the knowledge about implications of developmental biology in various fields, such as in teratogenesis, vitelogenesis, stem cell biology, in vitro fertilization, cryopreservation, cord blood transfusion etc.
- ➢ Students will understand the classification of toxic agents and types of pollutants air, water, soil and their effects and remedial measures.

Programme Outcomes of B.Sc.: Botany

1. Transformed curriculum shall develop educated outcome-oriented candidature, fostered with discovery- learning, equipped with practice & skills to deal practical problems and versed with recent pedagogical trends in education including e-learning, flipped class and hybrid learning to develop into responsible citizen for nation-building and transforming the country towards the future with their knowledge gained in the field of plant science.
2. The syllabus is prepared to enable students for competitive exams in frontier areas of plant sciences.
3. The three year learning outcome of graduation will provide understanding of plant systematic, economic botany, developmental biology, ecology, statistics, physiology, biochemistry.
4. After completing this course successfully students will be able to contribute in the field of plant sciences.
5. Lifelong learning is achieved by drawing attention to the vast world of knowledge of plants and their domestication.
6. Students will be able to know about habit, habitat, morphology, anatomy and reproduction of various plant groups.
7. Laboratory sessions following theory will provide easy understanding of internal structure of various plant parts, structural organization, reproductive biology and genetics.
8. It will provide expertise in conservation biology and reproduction biology.

Course Outcomes:

B.Sc. I

Paper Name: Fungi, Elementary Microbiology and Plant Pathology

After completing this course, students will be able to

1. Learning about structure, classification, reproduction of fungi, microorganism (bacteria and viruses)
2. Learn about host pathogen relationship
3. Receive the basic knowledge of plants disease symptoms of disease, their filed study identification of disease etc.
4. Differentiate between fungi and microorganism.

5- About control of plant disease and economic importance of bactria.
6- Gain knowledge about use microbes in various field.
7- achieve practical skills in the field of pathology & microbiology and laboratory experiments.

Paper Name: Algae and Bryophyles

After completing this course, students will be able to

1- Develop understanding about classification and diversity of different Algae and Bryophyles and their economic importance.
2- Understand the structure and reproduction of Algae
3- Develop critical understanding on morphology, anatomy and reproduction of Bryophyles.

Paper Name: Pteridophytes and Gymnosperms

After completing this course, students will be able to

1- Develop critical understanding on morphology anatomy and reproduction of pleridophytes and Gymnosperms
2- Understanding of plant evolution and their transition to land habitat.
3- To learn the major patterns of diversity among plants, and the characters and types of data used to classify plants.
4- To compare the different approaches to classification with regard to the analysis of data.

B.Sc. II

Paper Name: Taxonomy of Angiosperms and Economic Botany

After completing this course, students will be able to

1- Learn the application of morphology in plant identification, classification and nomenclature of Angiosperms.
2- Learn Plant collection, preservation techniques and can identify plant in field.
3- Learn the techniques of vegetation studies and its application.
4- To discover and use diverse taxonomic resources, reference materials, herbarium collections.
5- To compare the different approaches to classification with regard to the analysis of data of angiosperms.

6- Understand about the uses of plants –will know one plant-one employment .

7- Understand phytochemical analysis related to medicinally important plants and economic products produced by the plants .

8- know about the importance of Medicinal plants and its useful parts, economically important plants in our daily life and also about the traditional medicines and herbs, and its relevance in modern times.

Paper Name: Anatomy, Embryology and Elementary Morphogenesis

After completing this course, students will be able to

1- Define terms related to plant Anatomy, Embryology.
2- Describe various tissue systems in plants like epidermal, mechanical and vascular
3- Interpret the Principles involved in distribution of mechanical tissues.
4- Explain the process of normal and abnormal secondary growth in plants.
5- Differentiate between normal and abnormal secondary growth.
6- Identify the process of pollination and fertilization.
7- Discuss the Structure and development process of male and female gametophyte.
8- Illustrate the types of microspore, ovules, embryo, seed and endosperm.

Paper Name: Ecology and Remote Sensing

1- Acquaint the students with complex interrelationship between organisms and environment,
2- make them understand methods for studying vegetation, community patterns and processes, ecosystem functions, and principles of phytogeography
3- This knowledge is critical in evolving strategies for sustainable natural resource management and biodiversity conservation.

B.Sc. III

Paper Name: Cytogenetics, Molecular Biology and Biotechnology

After completing this course, students will be able to
1- Define terminologies related to cell and molecular biology
2- Identify localization and describe all cell organelles
3- Discuss the dynamics of plant cell structure and function
4- Describe Nucleus and chromosomes
5- Understand the genetic terminology of genetics and laws of mendelism.

6- Understand and solve the various example of interaction of genes and multiple alleles
7- Construction of linkage map by test cross
8- Describe DNA replication, Transcription and Translation.
9- Explain gene action and regulation (concept of operon, its structure and regulation).
10- Interpret the genomic organization and its role in gene expression.
11- Define the terminologies related to plant biotechnology.
12- Interpret the production of Single cell proteins.

Paper Name: Plant Physiology and Elementary Biochemistry

After completing this course, students will be able to

1- Define the terminologies: Plant water relations, Growth, Transpiration, Ascent of Sap, Plant growth regulators and Nitrogen metabolism.
2- Explain processes of mineral nutrition, absorption of water, ascent of sap, mechanisms of water loss from plants.
3- Demonstrate processes imbibition, Osmosis, Diffusion and Plasmolysis, measure growth by arc auxanometer, Bose Cresco graph.
4- Describe Plant growth regulators and their types and Discuss nitrogen metabolism in plants
5- Explain mechanisms and application of photoperiodism, vernalisation and classify the plants based on Photoperiodism.
6- Learn the symptoms of Mineral Deficiency in crops and their management.
7- Assimilate Knowledge about Biochemical constitution of plant diversity.

Paper Name: Plant Breeding and Biostatics

After completing this course, students will be able to

1- Understand the plant breeding and hetrosis and mutation in plant breading.
2- Understand the concept of 'one gene one enzyme hypothesis' along with molecular mechanism of mutation.
3- Classification of data, mean, median and mode. Standard deviation, standard error, variance, co-relation, $\chi2$ test and experimental designs.