Shrikrishna Shikshnan Sanstha,Gunjoti

Shrikrishna Mahavidyalaya,Gunjoti

Programme Specific Outcomes and Course Outcomes

Programme	Programme Specific Outcomes	Course	Course Outcomes
B.Sc.Mathematics	PSO1: Acquire knowledge in basic Mathematics PSO2: Communicate solutions of mathematical problems effectively PSO3: Equip knowledge in various concepts involve in Calculus, differential equation, real analysis and algebra PSO4: Acquire a breadth and depth of understanding in mathematics PSO5: Understand reasonableness of solutions including sign, size, accuracy and units of measurement PSO6: Apply mathematical proof techniques in a wide variety of mathematical areas, including algebra and analysis	Differential Calculus	**CO1:** Solve problems on limits continuity and successive differentiation of Functions CO2: Determine partial derivative of function more than one variable CO3: Describe Rolle's Theorem, Lagrange's mean value theorem and Cauchy's mean value theorem CO4: Determine expansion of ex, sinx, cosx, sinhx, coshx, tanhx, log (ax+b) etc. CO5: Determine gradient, divergence and curl and directional derivatives
		Differential Equations	CO1: Determine solution of first order linear differential equation CO2: Determine solution of exact differential equation CO3: Determine solution of linear equation with constant coefficient using general and short method CO4: Determine solution of linear homogeneous differential equation CO5: Explain formation of partial differential equation by eliminating the arbitrary constants and function
		Integral Calculus	CO1: Apply reduction formula CO2: Find integration of algebraic rational functions CO3: Apply fundamental theorem of integral calculus CO4: Find the area bounded by a curve CO5: Calculate the length of arc of a curve. CO6: Find line integral and surface integrals CO7: Apply the theorems of Gauss, Green's and Stoke's theorem

		Geometry	CO1: Identify and use different type of equations of plane CO2: Determine equations of the system of planes and the length of perpendicular to a plane CO3: Determine equation of right line and the angle between the plane and line CO4: Determine condition for coplanar lines and short distance between two lines CO5: Determine equation of sphere and its intersection with the plane
		Number Theory	CO1: Describe division algorithm CO2: Determine GCD and LCM by using Euclidean algorithm CO3: Describe method of solving linear Diophantine equation CO4: Determine solution of linear congruence CO5: Describe Fermat's and Euler's theorem
		Integral Transform	CO1: Define beta and gamma functions and derive their properties and apply them in evaluating integrals CO2: Determine Laplace transform for various functions, properties of Laplace transforms CO3: Determine inverse Laplace transform, properties of inverse Laplace Transform, solve the problems using convolution theorem CO4: Determine Fourier transform, properties of Fourier transform, Fourier sine and cosine transforms CO5: Apply Laplace transform to find solutions of ordinary and partial differential equations
		Mechanics-I	CO1: Describe different types of forces, triangle law of forces, Parallelogram of forces, resultant of forces, sine rule and cosine rule CO2: Explain resultant of several coplanar forces, equation of the line of action of the resultant, equilibrium of a rigid body under 3 coplanar forces CO3: Explain Lammi's theorem and polygon of forces CO4: Explain vector moment of a force and vector moment of couple and describe basic concepts of centre of gravity and its applications

		Numerical Methods	CO1: Explain Bisection Method, Method of False Position, Newton-Raphson Method CO2: Describe Finite Differences, Newton's Formula for Interpolation, Lagrange's Interpolation Formula, Divided Differences CO3: Describe Least Square Curve Fitting Procedures, Fitting a straight line, Chebyshev polynomial, Power series CO4: Calculate Solution of Linear system of equations, Eigen values and Eigen Vectors CO5: Calculate solution of ordinary differential equation by Taylor's series Method, Picard's Method, Euler's Method
		Partial Differential Equations	CO1: Solve Lagrange's equation CO2: Find different types of solutions like complete integral, Singular integral and general integral CO3: Determine the solution of partial differential equations using Charpit's Method CO4: Classify partial differential equations to special types CO5: Describe Monge's Method, Method of transformation
		Mechanics-II	CO1: Find velocity and acceleration in terms of vector derivatives, curvature, Angular speed and angular velocity CO2: Describe Radial and Transverse components of velocity and acceleration, areal speed and velocity CO3: Explain Newton's Law of motion, angular momentum, work, energy, vector point function, Field of force CO4: Describe motion under gravity, projectile, Motion of projectile, Parabola of safety,motion in resisting medium,areal velocity of central orbit, Pedal's equation
		Real Analysis-I	CO1: Describe sets, functions, real valued functions, countable sets, Least upper Bound axiom and greatest lower bound axiom. CO2: Give different types of sequences and its properties CO3: Describe limit superior, limit inferior and Cauchy sequence CO4: Explain basic concepts of series and absolute and conditional convergence of the series

		Abstract Algebra-I	CO1: Explain elementary concepts of sets, functions and integrals CO2: Describe group, subgroup, counting principle, Normal subgroup, Quotient groups, Homomorphism CO3: Define Ring, some special types of ring CO4: Describe Ideals, Maximal Ideals, Explain quotient ring, polynomial ring
		Ordinary Differential Equations-I	CO1: Classify different types of functions and Explain complex exponential function and their properties, Solve system of linear equations CO2: Describe and find the solution of first order linear differential equations CO3: Evaluate the solution of linear equations with constant coefficients
		Real Analysis-II	CO1: Find Limits in Metric spaces CO2: Explain continuous functions on Metric spaces CO3: Describe connectedness, completeness and compactness CO4: Describe set of Measure zero, Riemann integral, Fundamental theorem of calculus,Explain Fourier series.
		Abstract Algebra-II	CO1: Describe elementary basic concepts of vector spaces CO2: Explain Linear independence and bases CO3: Describe dual spaces and inner product spaces CO4: Explain modules with illustrations
		Ordinary Differential Equations-II	CO1: Evaluate the solution of linear equations with variable coefficients CO2:Identify the solutions are linearly dependent or independent using Wronskian and find the series solution of linear equations with analytic coefficients CO3:Describe and find the solution of linear equations with reguar singular points

B.Sc.Physics	PSO1: Understand basic concepts of Mechanics, Optics, Thermodynamics and Mathematical methods of Physics PSO2: Use effectively various basic measuring Instruments in laboratory PSO3: Acquire Knowledge of mathematical Physics, Electronics, Statistical Physics and its applications PSO4: Understand basic Laws of practical Physics PSO5: Draw appropriate conclusions on outcomes of experiments PSO6: Acquire ability to understand different types of crystal structures, classical and quantum theory of specific Heat, Electrodynamics with applications and Fibre Optics and its uses PSO7: Understand and apply simple basics of Quantum mechanics PSO8: Understand and solve Maxwell's equations PSO9: Gain comprehensive knowledge of various techniques used in laser and its applications	Mechanics	CO1: Describe acceleration due to gravity, Newton's law of gravitation and basics of potential and fields CO2: Discuss basic properties of matter, Young's modulus, Bulk modulus and Modulus of rigidity CO3: Discuss properties of matter especially viscosity and surface tension CO4: Define the general terms in acoustics intensity, loudness, reverberation etc.
		Heat and Thermodynamics	CO1: Define Thermal Conductivity, coefficient of thermal conductivity, Thermal diffusivity, and resistivity; give comparison of conductivities of various metals CO2: Describe reason for modification of gas equation; derive Vander Waals equation of state; define critical constants CO3: Explain Transport phenomenon, mean free path with expression, thermal conductivity and viscosity CO4: Formulate and solve problems in Thermodynamics and Heat; explain adiabatic Process, isothermal process, reversible process, irreversible process and derive relevant equation, draw indicator diagram CO5: Derive Thermodynamic parameters, Heat engine and Carnot Heat Engine, Maxwell's equation and their applications
		Geometrical and Physical Optics	CO1: Describe and determine concept of cardinal point and different eye pieces CO2: Explain interference phenomenon of light and its relevant experiments CO3: Explain concept of diffraction of light and grating CO4: Describe polarization of light and its related Experiments
		Electricity and Magnetism	CO1: Describe the concept of Scalar, vector triple product of vector algebra and Solve divergence, gradient and curl CO2: Explain Coulomb's law, Gauss law and dielectrics with mathematical derivation CO3: Explain the concept of Biot-Savrat's Law, Ampere's Law and Ballistic Galvanometer CO4: Elaborate growth and decay of LCR circuit

		Mathematical Physics and Relativity	CO1: Explain partial differentiation, successive differentiation and total differentiation CO2: Describe ordinary differential equation and solutions of first and second order differentiation equation CO3: Elaborate theories and methods of statistical Physics and quantum statics CO4: Explain principle of special theory of relativity and derive relevant equations including Einstein equation
		Modern Physics	CO1: Explain Photoelectric Effect and its applications in various processes CO2: Describe X- Ray radiation and its spectra CO3: Explain theoretical aspect of Atomic mass, nuclear fission and Energy released in nucleus CO4: Describe Particle accelerator, Cyclotron and Deuterons
		General Electronics	CO1: Describe semiconductors, Zener diode, Transistor and give its application CO2: Explain Amplifier, RC coupling and Transistor biasing and discuss its applications CO3: Describe theoretical and practical aspects of Oscillator and Multi-vibrator CO4: Elaborate modulation, FM Modulation and AM wave
		Solid State Physics	CO1: Explain types of solids, miller indices, inter planner spacing and different types of Crystal structures CO2: Elaborate concept of inter atomic forces and Kroning Penney Model CO3: Describe classical theory of lattice heat capacity and Debye model; discuss limitations of Debye model CO4: Discuss applications of free electron theory of Metals, Hall effect, Hall voltage and Hall coefficient and importance of Hall Effect CO5: Describe transport properties of electrical conductivity thermal conductivity

		Classical and Quantum Mechanics	CO1- Explain basic concept of Classical Mechanics, mechanics of particle, and mechanics of system of particle by using Newton's laws of motion CO2- Derive Lagrange's equation and its various applications CO3- Explain basic concepts of constraints, its types and Virtual work done CO4- Discuss mathematical basics of quantum mechanics, explain matter wave, Group velocity, particle velocity, operators, wave function and expectation values CO5- Derive Schrodinger time dependent and independent equation and describe particle in one-dimensional box
		Electrodynamics	CO1: Describe and understand diversions, curl, and Gauss Law applications in Electrostatics CO2: Explain concepts of self-induction, mutual induction and equation of continuity CO3: Describe origin of Maxwell's equations in magnetic and dielectric media CO4: Derive electromagnetic wave equation in conduction medium CO5: Explain transport of energy and poyinting vector, poyinting theorem CO6: Describe boundary condition for electromagnetic field vectors B, E, D and H
		Atomic, Molecular Physics & LASER	CO1: Explain Thomson's atom model, Rutherford's nuclear atom model and Bohr's atom model CO2: Describe the concepts of Vector atom model, quantum numbers, Coupling Scheme and Pauli's exclusive principle CO3: Explain Zeeman Effect and Stark effect CO4: Describe Rotation, Vibration Spectra, Raman Effect and its applications in various fields CO5: Discuss LASER system and its properties, types of LASER and its medical, biological and industrial applications

		Non-conventional Energy Sources and Optical Fiber	CO1: Explain the concept of technologies of non-conventional sources of energy CO2: Describe various renewable energy technology CO3: Discuss non-conventional energy sources: Biomass, wind energy, tidal energy, ocean energy, geothermal energy and solar energy CO4: Elaborate the concept of solar energy and its applications in various fields CO5: Describe structures of optical fibers CO6: Describe fiber fabrication techniques and testing of optical fiber cables
B.Sc.Botany	PSO1: Understand the basic concepts of taxonomy and ecology PSO2: Acquire knowledge about economics and medicinal plants in agriculture and medicine PSO3: Analyse the relationship between plants and microbes PSO4: Understand the biology of diversity of seed plants or phanerogams PSO5: Understand behaviours of fossils and gymnosperm plants PSO6: Understand plant diseases, chemical properties and evolutionary relationship among taxonomic groups	Diversity of Cryptogams-I	CO1: Identify various types of plants in kingdom Plantae CO2: Identify Cryptogams CO3: Identify various types of Algae CO4: Describe various types of bacteria CO5: Describe various types of fungi CO6: Identify various types of viruses
		Morphology of Angiosperms	CO1: Describe various types of habitat habit and morphological characters CO2: Identify various types of root, stem and leaves CO3: Identify various types of inflorescence and flowers CO4: Identify various types of fruits CO5: Describe modifications of roots stems and leaves
		Diversity of Cryptogams-II	CO1: Describe Cryptogams CO2: Describe characteristic feature of Bryophytes CO3: Describe Characteristic feature of Pteridophytes CO4: Identify various types of Bryophytes CO5: Identify various types of Pteridophytes
		Histology, Anatomy and Embryology	CO1: Describe various types of tissues CO2: Describe anatomical characters of monocot and dicot plants CO3: Describe various types of ovules CO4: Describe vascular elements in tissues

		Taxonomy of Angiosperms	CO1: Describe various Classification Systems of plants CO2: Describe characteristics of various angiosperm families CO3: Describe various taxonomic terminologies CO4: Describe importance of plant studies CO5: Describe various tools used in taxonomy
		Plant Ecology	CO1: Describe importance of plant studies CO2: Describe various terminologies used in ecology CO3: Describe soil structure and soil types CO4: Describe various methods of conservation CO5: Describe ecological adaptations in plants
		Gymnosperms and Utilization of plants	CO1: Differentiate angiosperm and gymnosperm CO2: Describe the characteristic feature of gymnosperm plants CO3: Describe economic importance of cereals pulses CO4: Describe importance of timber plants CO5: Describe medicinal values of plants CO6: Describe uses of plants and their parts in various industries
		Plant Physiology	CO1: Describe various physiological processes of plants CO2: Describe photosynthesis CO3: Describe transpiration CO4: Describe respiration CO5: Describe stomata and functions of stomata CO6: Describe osmosis
		Cell & Molecular Biology	CO1: Describe Cell and cell structure CO2: Describe molecular basis of cell CO3: Describe various types of cells CO4: Describe mitosis and meiosis CO5: Identify various cell organelles CO6: Describe various stages of cell division

		Diversity of Angiosperms-I	CO1: Describe various Classification Systems of plants CO2: Describe variations among angiosperm families CO3: Describe various types of keys used for plant identification CO4: Describe various floral characters of angiosperm families CO5: Describe importance of plant studies and uses of plants
		Genetics & Biotechnology	CO1: Describe genetics CO2: Describe the basic information about gene, hybridisation and genetic material CO3: Describe various genetic abnormalities CO4: Describe mutation and chromosomal aberrations CO5: Describe uses and applications of r-DNA technology
		Diversity of Angiosperms – II	CO1: Describe characteristic feature of various families of angiosperm plants CO2: Describe the importance of plants of various families CO3: Describe various tools used in taxonomy CO4: Describe botanical gardens, bio-reservoirs and conserved forests CO5: Describe herbariums and gene banks
M.Sc. Mathematics	PSO1: Acquire advanced knowledge in Mathematics PSO2: Able to solve complex mathematical problems effectively PSO3: Equip knowledge in various concepts involved in Algebra, Real analysis, Complex analysis, discrete Mathematics, Mechanics, Functional analysis and Difference equations	Advanced Abstract Algebra- I	CO1: Describe binary relation, binary operation, group, subgroup, cyclic group CO2: Describe Lagrange's theorem, Fermat's and Euler's Theorem CO3: Explain in detail Normal subgroup, quotient group, fundamental theorem of group homomorphism, automorphism CO4: Explain permutation group, centre, Normaliser, derived group, Cayles Theorem, Describe Normal series, solvable and Nilpotent group, alternating group CO5: State Fundamental theorem of finitely generated abelian group, Sylow theorems and applications

	PSO4: Acquire a breadth and depth of understanding of advances in Mathematics PSO5: Able to solve differential and difference equations PSO6: Acquire the knowledge of stereographic projections in complex analysis	Real Analysis-I	CO1: Explain Riemann Stielties integrals and its properties CO2: Describe sequence and series of functions and learn their tests for Convergence CO3: State Weierstrass theorem, Abel's and Taylor's Theorem CO4: Explain functions of several variables, chain rule CO5: Describe inverse function theorem, implicit function theorem
		Topology-I	CO1: Explain countable, uncountable sets, principle of induction, metric spaces, open sets, closed sets CO2: Describe Closure of a set, interior of a set and their properties CO3: Describe bases and subbases, product space, weak topology CO4: Describe evaluation map and related results CO5: Describe directed sets, net, cluster point, subnet, ultranet, filter
		Complex Analysis- I	CO1: Describe complex number system CO2: Describe metric spaces, connectedness, compactness, uniform Convergence CO3: Explain elementary properties of exponential function, trigonometric and hyperbolic functions, roots of unity, Cauchy-Riemann equations, harmonic functions CO4: Explain analytic functions as a mapping, Mobius transformations, bilinear transformation CO5: Define the index of a closed curve, Cauchy's theorem, Gaursat's theorem, singularities
		Differential Equations-I	CO1: Apply method of successive approximations for first order linear differential equations, explain and apply Lipschitz condition and Peano's theorem. CO2:Analyze and explain existence of solutions and use of differential inequality CO3:Apply and describe integral inequalities CO4:Analyze existence of solutions of linear systems CO5:Describeand apply adjoint system, periodic system and in-homogeneous systems.

		Advanced Abstract Algebra- II	CO1: Describe Ring, Ideals and their properties CO2: Define Vector spaces, Linear dependence and independence, Basis and Modules CO3: Explain linear transformation, characteristic roots and triangular form CO4: Describe Extension field, irreducible polynomial and finite fields CO5: Describe automorphism of group, Galois Theory, polynomial solvable by radicals
		Real Analysis-II	CO1: Explain measure, measurable sets, Borel and Lebegue measurability CO2: Explain integration of functions of real variable and Integration of series CO3: Describe Riemann and Lebeque integral and functions of bounded variations CO4: Describe abstract measure spaces and integration with respective to a Measure CO5: Explain LP spaces, convex functions, Jensen's inequality and almost uniform convergence
		Topology-II	CO1: Describe Separation axioms, T0, T1, T2 spaces, their properties and characterizations CO2: Define Normal spaces, T4 spaces, Urysorn's lemma, second countable spaces and Lindelof spaces CO3: Define compactness, sequentially and countably compact spaces CO4: Describe Lebesgue covering lemma, Urysohn's metrization theorem and metrizability of T0 spaces CO5: Explain connected spaces, components, simple chain, path wise and Locally connected
		Complex Analysis- II	CO1: Explain compactness and convergence in the space of Analytic functions, Factorization of the sine function, the gamma function CO2: Describe Harmonic functions, basic properties of harmonic function, Poisson integral formula CO3: Describe entire functions, Jensen's formulae, the genus and Order of an entire function, Wadamard Factorization theorem CO4: Describe Univalent function CO5: Explain Analytic continuation, special functions

		Differential Equations-II	CO1: Explain basic ideas of Lagrange's identity, transformation CO2:Describe and apply maximum principle to different types of problems CO3:Explain and apply comparison theorems CO4:Describe eigen values and eigen functions CO5:Describe non-oscillatory systems.
		Functional Analysis	CO1: Explain normed linear space, Banach spaces and Examples CO2: Describe bounded linear transformations, Hahn-Banach Theorem, Reflexive spaces CO3: Explain open mapping theorem, closed graph theorem, inner product Spaces CO4: Describe Hilbert spaces and its properties, Bessel's inequality, Parseval's Identity CO5: Explain self Adjoint operator, eigen values and eigen spaces, finite dimensional spectral theorem
		Partial differential equation	CO1: Give classification of second order partial differential equation, Laplace Equations and Poisson's equation CO2: Describe harmonic functions, Green's function, Energy method and uniqueness CO3: Explain fundamental solution of heat equation, Initial value problem, Mean value formula CO4: Describe non-linear first order complete integral CO5: Explain transformation method, Fourier transform and Laplace transform, arabolic partial differential equation with quadratic number linearity, Burger's equation with viscosity
		Numerical Analysis	CO1: Determine solution of algebraic and transcendental equation by various methods CO2: Determine solution of system of linear equation by Gauss Elimination method, iteration method, Gauss Seidal method, SOR method CO3: Explain finite differences, Lagranges and Newton interpolation, piecewise and spleen interpolation CO4: Explain differentiation and integration CO5: Determine solution of ordinary differential equation by Taylor's series, Picard method, Euler method, Runge-Kutta method

		Lattice Theory	CO1: Describe partially order set, lattice as a poset, lattice as a algebra, Hasse Diagram, Meet and join tables CO2: Describe Isotone maps, sublattites, ideals, complete lattice and their Properties CO3: Describe distributive and modular lattice, Demorgan's identities, Boolean algebra, Dedikinds modularity criterion CO4: Describe Stone theorem, distributive lattices with pseudo Complementation CO5: Define join infinite distributive identity, distributive Standard and neutral elements
		Operations Research-I	CO1: Explain basics of LPP CO2: Describe and apply graphical and simplex method to find solution of LPP CO3: Describe duality problem and dual simplex method CO4: Explain transportation and assignment problem and apply methods to solve it. CO5: Write a project report
		Linear Integral Equations	CO1: Describe linear integral equations types of linear integral equations, Symmetrical kernel CO2: Find solution of linear integral equations, verification of solution of Linear integral equations CO3: Describe the differential method of finding the solution of Fredholm Integral equation and Volterra integral equations CO4: Describe symmetric kernel, trace of kernel, Hilbert – schmidth Theorem CO5: Describe integral transform methods, Fourier transform, applications to Volterra integral equations, Green's function, approach for ordinary Differential equations
		Mechanics	CO1: Describe D'alemberts principal and Lagrange's equation of motion CO2: Explain Functional, Euler's equations and Motivating problems of calculus of variations CO3: Explain the fixed end point problem for n unknown

			functions and variational problems in parametric form CO4: Describe Hamilton principle and applications of Hamilton's formulation, Cyclic coordinates, conservation theorem CO5: Describe two dimensional motion of rigid bodies Cayley- Klein parameters and related quantities
		Linear Algebra	CO1: Explain linear dependence and independence, bases and dimensions of vector spaces CO2: Describe and apply linear transformations CO3: Describe isomorphism, and dual spaces etc. CO3: Explain eigen values, eigen vectors and Caley-Hamilton theorem CO4: Explain inner product spaces and canonical forms
		Fuzzy Mathematics	CO1: Describe theory of Fuzzy sets as measure of uncertainty and ambiguity Fuzzy logic. CO2: Describe basic concepts in fuzzy sets, convex fuzzy sets CO3: Give properties of α-cuts, Decomposition theorem, operations on fuzzy sets CO4: Describe fuzzy arithmetic, fuzzy numbers, arithmetic operations on fuzzy numbers CO5: Explain fuzzy relations, fuzzy prepositions and their interpretation in terms of fuzzy sets, fuzzy rules
		Operation Research-II	CO1: Describe and apply dynamic programming to find solution of LPP CO2: Describe and solve nonlinear programming problem CO3:Explain industrial problems using replacement problem CO4:Evaluate shortest path and critical path for a problem CO5: Explain and solve PERT/PM

IQAC Coordinator

Principal