GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON

TEACHING PLAN

2022-2023

DEPARTMENT OF MATHEMATICS

GOVT. DIGVIJAY AUTO. P.G. COLLEGE, RAJNANDGAON
Department of Mathematics
Teaching Plan
Session 2022-23

Class : B.Sc. I Semester

Subject : DSC- Mathematics

Paper : Calculus

S. No.	Teacher	Month	
1.	Dr. K.K.Dewangan	September	Unit II: Reduction formulae
		October	Definite integrals,
		November	Quadrature, Rectification,
		December	Volumes and surfaces of solids of revolution.
2.	Dr. Hemant Kumar Sao	September	Unit I: Successive differentiation. Leibnitz theorem
		October	Maclaurin and Taylor series expansions, Asymptotes, Curvature
		November	Tests for concavity and convexity, Points of inflexion, Multiple points,
		December	Tracing of curves in Cartesian and polar co-ordinates.
3.	Mrs. Kavita Sakure	September	Unit IV : Scalar and vector product of three vectors. Product of four vectors.
		October	Reciprocal Vectors. Vector differentiation.
		November	Gradient, divergence and curl, Vector integration.
		December	Theorems of Gauss, Green, Stokes and problems based on these.
4.	Mr. Ravi Sonkar	September	Unit III : Limit, continuity and first order partial derivatives
		October	Higherorder partial derivatives
		November	Change of variables, Euler's theorem for homogeneous functions
		December	Taylor's theorem, Total differentiation and Jacobians.

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Department of Mathematics
Teaching Plan
Session 2022-23

Class : B.Sc. II Semester

Subject : DSC- Mathematics

Paper : Differential Equations

S. No.	Teacher	Month	
1.	Dr. K.K.Dewangan	January	Unit II: Second Order Linear Differential Equations Statement of existence and uniqueness theorem for the solution of linear differential equations
		February	General theory of linear differential equations of second order with variable coefficients.
		March	Solutions of homogeneous linear ordinary differential equations of second order with constant coefficients, Method of variation of parameters and method of undetermined coefficients
		April	Reduction of order, Euler-Cauchy equations, Coupled (Simultaneous) linear differential Equations with constant coefficients.
2.	Dr. Hemant Kumar Sao	January	Unit IV: Higher Order Linear Differential Equations and Application of Differential Equations Orthogonal Trajectories of One-parameter families of curve in a plane.
		February	Simple Harmonic motion
		March	Simple pendulum, gain and loss of oscillations
		April	Oscillations of string, oscillatory electrical circuits.
3.	Mrs. Kavita Sakure	January	Unit III: First Order Partial Differential Equations Genesis of Partial differential equations (PDE), Concept of linear and non-linear PDEs
		February	Methods of solution of Simultaneous differential equations of the form: $dx/P(x,y,z) = dy/Q(x,y,z) = dz/R(x,y,z)$
		March	Lagrange's method for PDEs of the form: $P(x,y,z)p+Q(x,y,z)q=R(x,y,z)$, where $p=\partial z/\partial x$ and $q=\partial z/\partial y$; Some special types of equation which can be solved easily other than general method.
		April	Charpit's General Method of Solution of PDE
4.	Mr. Ravi Sonkar	January	Unit I: Basic concepts and genesis of ordinary differential equations, Order and degree of a differential equation
		February	Linear differential equations and equations reducible to linear form
		March	Exact differential equations, Integrating factor
		April	First order higher degree equations solvable for x, y and p, Clairaut's form and singular solutions

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Department of Mathematics
Teaching Plan
Session 2022-23

Class : B.Sc. II

Subject : Mathematics

Paper : I (Advanced Calculus)

S. No.	Month	Unit	
1.	July	Unit I	Definition of sequence, Theorems on limits of sequence. Bounded and monotonic sequence. Cauchy's convergence criterion. series of non-negative terms. Comparison test
2.	August	Unit I	Cauchy's integral test, Raabe's, logarithem. DE Morgan and Bertrand's test. Alternating series, Leibinitz theorem. Absolute and conditional convergence,
3.	September	Unit II	Continuity, Sequentinal continuity, properties of continuous functions, Uniform continuity, Chain rule of differenentiability, Mean value theorem and their geometrical interpretation
4.	October	Unit II	Darboux's intermediate value theorem for derivation Taylor's theorem with various forms of remainders
		Unit III	Limits and continuity of functions of two variables partial differentiation change of variables ,
5.	November	Unit III	Euler's theorem on homogeneous functions, theorem for functions of two variables, Jacobians
6.	December	Unit IV	Envelopes, Evolutes, Maxima, minima and saddle point of functions two variables
7.	January	Unit V	Lagrange's multiplier metheod, Beta and Gamma function, Double and triple integrals, Dirichets integral,
8.	February	Unit V	change of order of intergration in double integrals.

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Department of Mathematics
Teaching Plan
Session 2022-23

Class : B.Sc. II

Subject : Mathematics

Paper : II (Differential Equations)

S. No.	Month	Unit	
1.	July	Unit I	series salutation of differential equations power series method, Bessel and Legender , function and their properties – convergence, recurrence and generatiing relations
2.	August	Unit I	Orthogonatily of function, Sturm – Liouville problem, Orthogonality of eigen – functions, Reality of Eigen value, Orthogonality of Bessal function and Legender polynomials,
3.	September	Unit II	Laplace Transformation – Linearity of the Laplace transforms, Laplace transforms of derivatives and integrals, Shifting theorems, Differentiation and integration of transform, Convolution theorems, solution of integral equations and systems of differential equations using the Laplace transformation.
4.	October	Unit III	Partial differential equations of the first order, Lagrange's solution, some special types of equations which can be solved easily by methods other than the general method, charpit's general method of solution
5.	November	Unit IV	Partial differential equation of the second and higher orders, classification of linear partial differential equation of the second order,
6.	December	Unit IV	Homogeneous and non – homogeneous equations with constant coefficients, partial differential equations reducible to equation with constant coefficients, monge's methods.
7.	January	Unit V	Calculus of Variations – variational problems with fixed boundaries – Euler's equation for functional containing, first order derivative and one independent variable, Externals, functionals dependent on higher order derivatives, functionals dependent on more than one independent variable, variational problems in parametric form, invariance of Euler's equation under coordinates transformations.
8.	February	Unit V	Variational problems with Moving Boundaries – Functionals dependent on one and two functions, one sided variations Sufficient conitions for an Extremum – Jacobi and Legendre conditions, Second Variation, Variational Principle of least action

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Department of Mathematics
Teaching Plan
Session 2022-23

Class : B.Sc. II

Subject : Mathematics

Paper : III (Mechanics)

S. No.	Month	Unit	
1.	July	Unit I	Analytical conditions of Equilibrium
2.	August	Unit I	Stable and unstable equilibirium, Virtual work, Catenary
3.	September	Unit II	Forces in three dimensions, Poinsot's central axis, Null lines and planes, Dynamics
4.	October	Unit III	Simple harmonic motion, Elastic strings, velocities and accelerations along radial and transverse direction, projectile, central orbits
5.	November	Unit IV	Kepler's laws of motion, velocities and acceleration in tangential and normal directions,
6.	December	Unit IV	motion on smooth and plane curves.
7.	January	Unit V	Motion a resisting medium, of particles of varying mass, motion of particle in three dimensions,
8.	February	Unit V	acceleration in terms of different co-ordinate systems.

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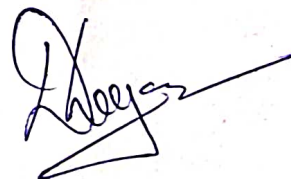## Department of Mathematics
Teaching Plan
Session 2022-23

Class : B.Sc. II

Subject : Mathematics

Paper : III (Mechanics)

S. No.	Month	Unit	
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Teaching Plan
Session 2022-23

Class : B.Sc. III

Subject : Mathematics

Paper : I (Analysis)

S. No.	Month	Unit	
1.	July	Unit I	Definition and examples of metric spaces. Neighborhoods, Limit points, Interior points, Open and closed sets, Closure and interior. Boundary points, Sub-space of a metric space. Cauchy sequences, Completeness, Cantor's intersection theorem
3.	August	Unit I	Contraction principle, Construction of real numbers as the completion of the incomplete metric space of rationals. Real numbers as a complete ordered field
4.	September	Unit II	Dense subsets. Baire Category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem. Compactness, Sequential compactness. Totally bounded spaces.
5.	October	Unit II	Finite intersection property. Continuous functions and compact sets, Connectedness, Continuous functions and connected sets
6.	November	Unit III	Complex numbers as ordered pairs. Geometric representation of complex numbers. Stereographic projection, continuity and differentiability of complex functions. Analytic functions. Cauchy-Riemann equations. Harmonic functions.
7	December	Unit III	Elementary functions. Mapping by elementary functions. Mobius transformations. Fixed points, cross ratio. Inverse points and critical mappings. Conformal mappings
		Unit IV	Fourier series. Fourier expansion of piecewise monotonic function. Convergence, divergence and Oscillation. Abel's and Dirichlet's test. Multiplication of series, Double series Partial derivation and differentiability of real-valued function of two variables. Schwarz and young's theorem, Implicit function theorem
8	January	Unit V	Riemann integral. Integrability of piecewise monotonic function. The fundamental theorem of integral calculus. Mean value theorems of integral calculus. Improper integrals and their convergence, comparison tests, Abel's and Dirichlet's tests. Frullani's integral.
9	February	Unit V	Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter

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Class : B.Sc. III

Subject : Mathematics

Paper : II (Abstract Algebra)

S. No.	Month	Unit	
1.	July	Unit I	Group-Automorphisms, inner automorphism. Automorphism groups and their computations, Conjugacy relation, Normaliser, Counting principle and the class equation of a finite group.
2.	August	Unit I	Center for Group lf prime-order, Abelianizing of a group and its universal property. Sylow's theorems, Sylow subgroup, Structure theorem for finite Abelian groups
3.	September	Unit II	Ring theory-Ring homomorphism. Ideals and Quotient Rings. Field of Quotients of an Integral Domain, Euclidean Rings, Polynomial Rings, Polynomials over the Rational Field. The Eisenstien Criterion, Polynomial Rings over Commutative Rings, Unique factorization domain. R unique factorization domain implies so is R [x1, x2------xn] Modules, Submodules, Quotient modules, Homomorphism and Isomorphism theorems
4.	October	Unit III	Definition and examples of vector spaces. Subspaces. Sum and direct sum of subspaces, Linear span. Linear dependence, independence and their basic properties, Basis. Finite dimensional vector spaces. Existence theoremfor bases. Invariance of subspace of a subspace of a finite dimensional vector space. Dimension of sums of subspaces. Quotient space and its dimension.
5.	November	Unit IV	Linear transformations and their representation as matrices. The Algebra of linear transformations. The rank nullity theorem. Change of basis. Dual space, Bidual space and natural isomorphism. Adjoint of a linear transformation.
6.	December	Unit IV	Eigenvalues and eigenvectors of a linear transformation. Diagonalisation. Annihilator of a subspace. Bilinear, Quadratic and Hermitian forms.
7.	January	Unit V	Inner Product Spaces-Cauchy-Schwarz inequality. Orthogonal vectors. Orthogonal Complements, Orthonormal sets and bases.
8.	February	Unit V	Bessel's inequality for finite dimensional spaces. Gram-Schmidt Orthogonalization process.

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Teaching Plan
Session 2022-23

Class : B.Sc. III

Subject : Mathematics

Paper : III (Programming in C and Numerical Analysis)

S. No.	Month	Unit	
1.	July	Unit I	Programmer's model of a computer. Algorithms. Flow Charts. Data Types. Arithmetic and input/output instructions. Decisions control structures. Decision statements. Logical and Conditional operators.
2.	August	Unit I	Case control structures. Functions. Recursions. Preprocessors. Arrays. Puppetting of strings. Structures. Pointers. File formatting.
3.	September	Unit II	Solution of Equations : Bisection, Secant, Regula Falsi, Newton's Method, Roots of Polynomials : Interpolation : Lagrange and Hermite Interpolation, Divided Differences, Difference Schemes, Interpolation Formulas using Differences. Numerical Differentiation. Numerical Quadrature : Newton- Cote's Formulas. Gauss Quadrature Formulas, Chebychev's Formulas
4.	October	Unit III	Linear Equations : Direct Methods for Solving. Systems of Linear Equations (Guass Elimination, LU Decomposition, Cholesky Decomposition), Iterative Methods (Jacobi, GaussSeidel, Relaxation Methods). The Algebraic Eigenvalue problem : Jacobi's Method, Givens' Method, Householder's Method, Power Method, QR Method, Lanezos' Method
5.	November	Unit IV	Ordinary Differential Equations : Euler Method, Single-step Methods, Runge-Kutta's Method, Multi-step Methods, Milne-Simpson Method. Methods Based on Numerical Integration, Methods Based on Numerical Differentiation, Boundary Value Problems, Eigenvalue Problems.
6.	December	Unit IV	Approximation : Different Types of Approximation, Least Square Polynomial Approximation, Polynomial Approximation using Orthogonal Polynomials, Approximation with Trigonometric Functions, Exponential Functions, Chebychev Polynomials, Rational Functions.
7.	January	Unit V	Monte Carlo Methods Random number generation, congruential generators, statistical tests of pseudo-random numbers. Random variate generation, inverse tranform method, composition method, acceptancerejection method, generation of exponential, normal variates, binomial and Poisson variates
8.	February	Unit V	Monte Carlo integration, hit or miss Monte Carlo integration, Monte Carlo integration for improper integrals, error analysis for Monte Carlo intergration

GOVT. DIGVIJAY AUTO. P.G. COLLEGE, RAJNANDGAON
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Teaching Plan
Session 2022-23

Class : M.Sc. IV Semester

Subject : Mathematics

Paper : I (Functional Analysis (II))

S. No.	Month	Unit	
1.	January	Unit I	Uniform Boundedness theorem and some of its consequences. Open Mapping and Closed Graphs Theorems
2.	February	Unit II	Hahn-Banach Theorem for real linear spaces. Complex linear spaces and normed linear spaces. Reflexive spaces. Weak Sequention Compactness. Compect Operators. Solvability of linear Equations in branch spaces. The closed range Theorem.
3.	March	Unit III	Inner product spaces. Hilbert Spaces. Orthonormal sets. Bessel's in quantity. Complete Orthonormal sets and parseveral's identity. Structure of Hilbert spaces. Projection Theorem. Riesz Representation Theorem.
4.	April	Unit IV	Adjonit of an Operator on a Hilbert spaces. Reflexivity of Hilbert space. Self-adjoint operators, Positive Projection Normal and Unitary Operators. Abstract Variational Boundrary-value Problem

(Dr . Shabnam Khan)

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Department of Mathematics
Teaching Plan
Session 2022-23

Class : M.Sc. IV Semester
Subject : Mathematics
Paper : II (Mechanics)

S. No.	Month	Unit	
1.	January	Unit I	Generalized Coordinates.Holonomic and Non Holonomic Systems,Scleronomic and Rhonomic systems.Generalized Potential.Lagrange's Equations of First kind Lagrange's Equations of second kind.Uniqueness of Solution.Energy Equation for Conservative Fields. Hamilton's Variables. Donkin's Theorem. Hamilton Canonical Equations. Cyclic Coordinates. Routh's equations.
2.	February	Unit II	Poisson's Bracket. Poission's Identity. Jacobi-poission's Theorem. Motivation Problems of calculus of variations, Shortest Distance. Minimum Surface of Revolution. Brachistochrone Problem. Isoperimetric Problem. Geodesic, Fundamental Lemma of Calculas of variations. Euler's Equations for one Dependent Function and its Generalization to (i) 'n' Dependent Functions, (ii) Higher Order Derivatives. Conditional Extremum under geometric , Constrainsts and under integral Constrainsts.Hamilton's Principle. Principles of least Action Poincare Carton Integral Invariant
3.	March	Unit III	Whittaker's Equations. Jacobi Equations. Statement of Lee Hwa Chungs Theorem. Hamilton-Jacobi Equations Theorem. Method of Sepration of variables. Lagrange Bracket.Condition of Canonical Character of a Transformation in Terms of Lagrange Brackets and Poisson Brackets under Canonical Transformations
4.	April	Unit IV	Attraction and Potential of rod, disc, Spherical shells and sphere, Surface Integral of normal Attraction with Application & gauss Theorem). Lap lace and Poisson equation. Work done of self attracting Systems. Distributions for a given Potential. Equipotential Surface. Surface and solid Harmonics. Surface density in terms of Surface harmonics.

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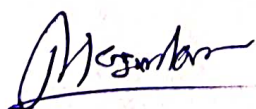## Department of Mathematics
Teaching Plan
Session 2022-23

Class : M.Sc. IV Semester

Subject : Mathematics

Paper : III (Programming In C (With ANSI Features) Theory (II))

S. No.	Month	Unit	
1.	January	Unit I	Storage Class-Fixed Vs Automatic Duration. Scope of Variables. The Register Specifier. Ansi rules for the syntax and Semantics of the Storage class Keywords
2.	February	Unit II	Pointers-Pointer Arithmetic, Passing pointer as Function Arguments. Accessing Array Elements Through Pointers. Passing Array as Function Arguments. Sorting Algorithms. Strings. Multidimensinal Arrays. Arrays of Pointers, Pointers to Pointers
3.	March	Unit III	Functions-Passing Argument, declaration and Calls. Pointers to Functions. Recursion. The main function, Complex Declarations the C Processor-Macro Substitution, Conditional Compilation. Include Facility. Line Control.
4.	April	Unit IV	Structures and Unions- Structures. Dynamic Memory Allocation. Linked Lists. Unions, Enum Declarations. Input and Output-Streams, Buffering. The <Studio.h> Header File. Error Handling. Opening and Closing a File. Reading and Writing Data. Selecting an I/O Method. Unbufferd I/O Random Access. The Standard Library for I/O.

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Department of Mathematics
Teaching Plan
Session 2022-23

Class : M.Sc. IV Semester
Subject : Mathematics
Paper : IV (Operations Research (II))

S. No.	Month	Unit	
1.	January	Unit I	Dynamic Programming- Deterministic and Probabilistic Dynamic Programming, Integer Programming – Branch and Bound Technique
2.	February	Unit II	Game Theory – Two-person, Zero sum Games. Games with Mixed Strategies, Graphical Solution, Solution by Linear Programming
3.	March	Unit III	Queuing system: Deterministic queuing system, Probability distribution in Queuing , Classification of Queuing models, Poisson Queuing system (M/M/I):(∞/FIFO), (M/M/I):(SIRO), (M/M/I):(N/FIFO), Inventory Control: The concept of EOQ , Deterministic inventory problem with no shortages
4.	April	Unit IV	Nonlinear Programming – One/ and Multi- Variable Unconstrained Optimization. Kuhn-Tucker Condition for Constrained Optimization, Quadratic Programming, Separable Programming, Convex Programming, Non-Convex Programming

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Department of Mathematics
Teaching Plan

Session 2022-23

Class : M.Sc. IV Semester

Subject : Mathematics

Paper : V (Fuzzy Sets and its Applications (II))

S. No.	Month	Unit	
1.	January	Unit I	Fuzzy Logic-An overview of classical logic, Multivalued logics, Fuzzy propositions. Fuzzy quantifiers. Linguistic variables and hedges. Inference from conditional fuzzy propositions, the compositional rule of inference
2.	February	Unit II	Approximate Reasoning-An overview of Fuzzy expert system. Fuzzy implications and their selection. Multiconditional approximate reasoning. The role of fuzzy relation equation
3.	March	Unit III	An introduction to Fuzzy Control-Fuzzy controllers. Fuzzy rule base. Fuzzy inference engine. Fuzzification Defuzzification and the various defuzzification methods (the centre of area, the centre of maxima, and the mean of maxima methods).
4.	April	Unit IV	Decision Making in Fuzzy Environment-Individual decision making. Multi person decision making. Multicriteria decision making. Multistage decision making. Fuzzy ranking methods. Fuzzy linear programming.

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Department of Mathematics
Teaching Plan
Session 2022-23

Class : M.Sc. II Semester

Subject : Mathematics

Paper : I (Advanced Abstract Algebra (II))

S. No.	Month	Unit	
1.	January	Unit I	Modules: Cyclic modules. Simple modules, Semi-Simple modules Schedular's Lemma, Free modules, Noetherian and Artinian modules and rings Hilbert basis Theorem,Wedderburn Artin Theorem, Uniform modules, Primary modules, and Noether- Lasker Theorem.
2.	February	Unit II	Linear Transformations: Algebra of Linear Transformations, characteristic roots, matrices and linear transformations
3.	March	Unit III	Form: Similarity of linear transformations. Invariant subspaces, Reduction to triangular forms. Nilpotent transformations, Index of Nilpotency, Invariants of a nilpotent transformation. The primary decomposition theorem, Jordan blocks and Jordon forms
4.	April	Unit IV	Smith normal form over a principal ideal domain and rank. Fundamental structure theorem for finitely generated modules over a principal ideal domain and its applications to finitely generated Abelian groups, Rational canonical form, Generalized Jordan form over and field

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Teaching Plan
Session 2022-23

Class : M.Sc. II Semester

Subject : Mathematics

Paper : II (Real Analysis (II))

S. No.	Month	Unit	
1.	January	Unit I	Definition and Existence of Riemann- stieltjes integral, Properties of the Riemann- stieltjes integral, Integration and Differentiation, The Fundamental Theorem of calculus, Integration of Vector-valued Functions, Rectifiable Curves
2.	February	Unit II	Lebesgue Outer measurability, Non measurable sets. Regularity, Measurable function Borel and Lebesgue measurability, Non measurable sets, Integration of Non-Negative Function, The General Integral. Integration of Series
3.	March	Unit III	Measures and Outer Measures, Extension of a Measure Uniqueness of Extension, Completion of a measure, Measure space, Integration on Masurable spaces with respect to a measure, Reimann and Lebesgue Integrals
4.	April	Unit IV	The four derivatives, Lebesgue Differentiation theorem, Differentiation and Integration, Function of bounded variation, The LP- Spaces. Convex Functions, Jensen's Inequality. Holder and Minkowski Inequalities, Completeness of LP, Convergence in Measure, Almost uniform Convergence.

Dr. Shabnam Khan

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Class : M.Sc. II Semester

Subject : Mathematics

Paper : III (General and Algebraic Topology)

S. No.	Month	Unit	
1.	January	Unit I	Tychonoff Product Topology in Terms of standard Sub base and its Characterizations. Projection Maps, Sepration axioms and product Spaces, Connectedness and product Spaces, Compactness and product Spaces (Tychonoff's theorem), Countability and product Spaces
2.	February	Unit II	Embedding and Metrization- Embedding Lemma and Tychonoff Embedding,The Urysohn Metrization Theorem. Local finiteness, The Nagata- Smirnov Metrization Theorem, Para Compactness, The Smirnov Metrization Theorem
3.	March	Unit III	Nets and Filter – Topology and Convergence of Nets, Hausdoffness and Nets, Compactness and Nets, Filters and their Convergence, Canonical way of Converting nets into filters and vice-versa. Ultra-Filters and Compactness
4.	April	Unit IV	The Fundamental Group and Covering Spaces- Homotopy of paths. The Fundamental group, Covering spaces, The Fundamental group of the Circle, The Fundamental Theorem of Algebra

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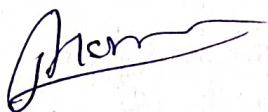## Department of Mathematics
Teaching Plan
Session 2022-23

Class : M.Sc. II Semester

Subject : Mathematics

Paper : IV (Complex Analysis (II))

S. No.	Month	Unit	
1.	January	Unit I	Weierstrass's Factorisation theorem, Gamma function and its properties, Riemann Zeta Function, Riemann's Functional equation, Runge's theorem. Mittag- Leffler's Theorem,
2.	February	Unit II	Analytic Continuation, Uniqueness of direct analytic Continuation. Uniqueness of Analytic Continuation along a Curve, Power series method of Analytic Continuation Schwarz Reflection, Principle, Monodromy theorem and its Consequences. Harmonic Functions on a Disk
3.	March	Unit III	Harnack's Inequality and Theorem, Dirichelet Problem. Green's Function, Canonical products, Jensen's Formula, Poisson-Jenson Formula, Hadamard's three circles theorem, Order of an entire function, Exponent of Convergence, Borel's theorem. Handamard's Factorization theorem
4.	April	Unit IV	The Range of an Analytic Function, Bloch's Theorem, The Little Picard theorem, Schottky's Theorem, Montel Caratheodory and the great Picard's theorem, Univalent Functions. Bieberbach's Conjecture (Statement only) and the "1/4-Theorem."

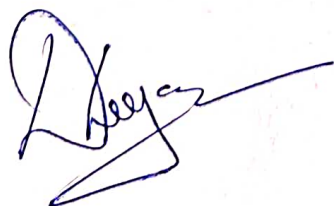# GOVT. DIGVIJAY AUTO. P.G. COLLEGE, RAJNANDGAON
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Session 2022-23

Class : M.Sc. II Semester

Subject : Mathematics

Paper : V (Advanced Discrete Mathematics (II))

S. No.	Month	Unit	
1.	January	Unit I	Graph Theory- Definition of (Undirected) Graphs, Paths, Circuits Cycles, & Subgraphs. Induced Subgraph, Degree of Vertex, Connectivity, Planar Graph and their properties, Trees, Euler's Formula for connected planar Graph, Complete & Complete Biparatite Graph, Kuratowski's Theorem (Statement Only) and its use
2.	February	Unit II	Spanning Trees, Cut-Sets, Fundamental Cut-Sets' and cycle, Minimal Spanning Trees and Kruskal's Algorithm, Matrix Representations of Graphs, Euler's Theorem on the Existence of Eulerian paths and circuits. Directed Graphs, In degree and Out Degree of a Vertex. Weighted undirected Graphs
3.	March	Unit III	Dijkstra's Algorithms, Strong Connectivity & warshall's Algorithm. Directed Trees, Search Tree. Tree Traversals, Introductory Computability Theory Finite state Mechanics and Their Transition Table Diagrams. Equivalence of finite State Machines, Reduced Machines, Homomorphism
4.	April	Unit IV	Finite Automata, Acceptors, Non- deterministic finite Automata and equivalence of its power to that of Deterministic Finite Automata, Moore and mealy Machines, Turing Machine and Partial Recursive Functions

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Teaching Plan
Session 2022-23

Class : M.Sc. I Semester

Subject : Mathematics

Paper : I (Advanced Abstract Algebra (I))

S. No.	Month	Unit	
1.	September	Unit 1	Groups-Normal And Subnormal Series, Composition Series, Jordan-Holder Theorem, Solvable Groups, Nilpotent Groups.
2.	October	Unit II	Field Theory: Extension Field, Finite extension, Algebraic element, Algebraic and Transcendental extensions, Roots of polynomials, Splitting field, Separable and inseparable extensions, Normal extensions
3.	November	Unit III	Simple extension, Primitive element, Perfect Field, Finite Fields, Algebraically closed Fields, Automorphisms of extensions
4.	December	Unit IV	Galois Extensions, Fundamental Theorem, Galois Theory. Solution of Polynomial equations by Radicals, Insolvability of the general question of degree 5 by Radicals

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Class : M.Sc. I Semester

Subject : Mathematics

Paper : II (Real Analysis (I))

S. No.	Month	Unit	
1.	September	Unit I	Sequence and series of function, Pointwise and uniform Convergence, Cauchy Criterion for uniform convergence, weierstrass M-Test.Abel's and Dirichlet's,Test for Uniform Convergence, Uniform Convergence and Continuity, Uniform Convergence and Differentiation, Weiestrass Approximation Theorem
2.	October	Unit II	Power Series, Uniqueness theorem for Power Series,Abel's and Tauber's Theorem. Rearrangements of terms of a Series, Riemann's theorem
3.	November	Unit III	Function of several variables, linear Transformations, Derivatives in an Open Subset of R^n Chain Rule, Partial, Deriavatives, Interchange of the order of differentiation, Derivatives of Higher Orders, Taylor's Theorem, Inverse Function Theoram, Implicit Function Theorem.
4.	December	Unit IV	Jacobians, Extremum problem with Constraints, Lagrange's multiplier method, Differentiation of Integrals, Partitions of unity, Differential Forms, Stoke's Theorem

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Class : M.Sc. I Semester

Subject : Mathematics

Paper : III (Topology)

S. No.	Month	Unit	
1.	September	Unit I	Countable and uncountable sets The Axiom of choice Cardinal numbers and its arithmetic. Schroeder – Berstein theorem, Cantor's theorem and continumm hypothesis, Zorn's lemma, well ordering theorem, Definition and examples of Topological spaces, Closed sets, Closure, Dense sets, Neighborhoods, Interior, exterior and boundary, Accumulation points and derived sets, Bases and sub-bases, Subspaces and relative topology,
2.	October	Unit II	Alternative methods of defining a topology in terms of Kuratowski Closure Operator and Neighbourhood Systems, Continuous functions and homeomorphism, First and second Countable spaces, Lindeloff's theorems, Separable Spaces, Second countability Separability
3.	November	Unit III / Unit IV	Separation axioms; their Characterization and basic properties.Urysohn's lemma, Tietze extension theorem. Compactness-Continuous functions and compact sets. Basic properties of compactness compactness and finite intersection property sequentially and count ably compact sets. Local compactness and one point compactification, Stone – Cech compactification. Compactness in metric spaces.
4.	December	Unit IV	Equivalence of compactness, countable compactness and sequential compactness in metric space.Connected Spaces. Connectedness on the real line. Components. Locally connected spaces

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Class : M.Sc. I Semester

Subject : Mathematics

Paper : IV (Complex Analysis (I))

S. No.	Month	Unit	
1.	September	Unit I	Complex Integration, Cauchy-Goursat Theorem. Cauchy's Integral Formula. Higher Order Derivatives .Morera's Theorem. Cauchy's Inequality and Liouville's Theorem.The Fundamental Theorem of Algebra, Taylor's Theorem. Laurent's Series. Isolated Singularities. Meromorphic Functions
2.	October	Unit II	Maximum Modulus Principle. Schwarz lemma. The argument Principle .Rouche's Theorem, Inverse Function Theorem.
3.	November	Unit III	Residues. Cauchy's residue Theorem .Billinear Transformations, their Properties and classifications .Definitions and examples of conformal mappings
4.	December	Unit IV	Evaluation of Integrals. Branches of Many Valued Functions With special Reference to arg Z, log Z and Zn. Spaces of Analytic Functions Hurwitz's Theorem, Montel's Theorem, Riemann Mapping Theorem

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Class : M.Sc. 1 Semester
Subject : Mathematics
Paper : V (Advanced Discrete Mathematics (I))

S. No.	Month	Unit	
1.	September	Unit I	Formal Logic-Statements, Symbolic Representation and Tautologies.Quantifiers, Predicates and validity. Propositional Logic. Semigroups and Monoids-Definitions And Examples of semigroups monoids (Including those pertaining to concatenation Operation).Homomorphism of Semi groups and monoids.
2.	October	Unit II	Congruence relation and Quotient Semi groups. Sub Semi Groups and submonoids. Direct Products.Basic Homomorphism Theorem. Lattices-Lattice as Partially orderd sets. Their Properties. Lattices and Algebraic systems. Sub lattices, and Homomorphisms. Some Special lattices e.g. Complete, Complemented and Distributive Lattices. Boolean Algebras-Boolean Algebras as Lattice.Various Boolean Identities, The Switching Algebra example, Sub algebras.
3.	November	Unit III	Direct Products and Homomorphisms.Join- Irreducible elements ,Atoms and Minterms. Boolean Forms and their Equivalence. Minterm and Boolean Forms, Sum Of Products Canonical Forms, Minimization of Boolean Functions. Applications of Boolean Algebra to Switching Theory (Using AND, OR, & NOT Gates).The Karnaugh Map Method
4.	December	Unit IV	Grammars and Languages-Phrase- Structure Grammars. Rewriting Rules, Derivation, Sentential Forms.Language generated by a Grammar. Regular, context Free and Context Sensutuve Grammars and Languages.Regular sets Regular Expressions and The Pumping Lemma. Kleene's Theorem Notions of Syntax Analysis, Polish Notations, Conversions of Infix Expression to Polish Notation. The Reverse Polish Notation

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Class : M.Sc. III Semester

Subject : Mathematics

Paper : I (Integration Theory and Functional Analysis (I))

S. No.	Month	Unit	
1.	July	Unit I	Signed Measure, Hahn Decomposition Theorem, Mutually singular measures, Radon-Nikodym, Labesgue decompostitions, Riesz Representation Theorem, Extension Theorem (Caratheodory)
2.	August	Unit II	Product measures, Fubinis Theorem. Differentiation and Integration, Decomposition into absolutely continuous, Baire sets, Baire measure, Continuous function with Compact support, Regularity of Measures on locally Compact spaces
3.	September	Unit III	Normed linear spaces, Banach spaces and examples, Quotient space of Normed linear spaces and its Completeness, Equivalent norms. Riesz Lemma. Basic properties of finite dimensional Normed linear spaces and Compactness
4.	October	Unit IV	Weak convergence and Bounded linear Transformations, Normed linear spaces of Bounded linear Transformations. Dual spaces with examples,
5.	November	Unit IV	Construction Mapping Theorem and its Application, Banach Fixed point Theorem, Picard's Theorem

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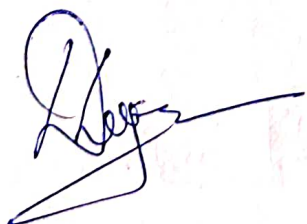# GOVT. DIGVIJAY AUTO. P.G. COLLEGE, RAJNANDGAON
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Class : M.Sc. I Semester

Subject : Mathematics

Paper : II (Partial Differential Equations)

S. No.	Month	Unit	
1.	August	Unit I	Examples of P.D.E. Classification, Transport Equation – Initial value Problem, Non-homogeneous Equation, Laplace's Equation-Fundamental Solution, Mean Value Formuae, Properties of Harmonic Functions, Green's Function, Energy Methods, Heat Equation Methods, Wave Equation-Solution by Spherical Means, Non-Homogeneous Function, Energy Methods
2.	September	Unit II	Nonlinear First Order PDE-Complete Integrals, Envelopes. Characteristics, Hamilton Jacobi Equation (Calculus of variations, Hamilton' ODE, Legender Transform, Hopf-Lax Formula, Weak Solutions, Uniqueness) Conservation Laws (Shocks, Entropy Condtion, Lax Oleinik formula, Weak Solutions, Uniqueness, Riemann's Problem, Long Time Behaviour
3.	October	Unit III	Representation of Soutions-seperation of Vaariables, Similarity Solutions (Plane and Travelling Waves, Solitons, Similarity under scaling) Fourier and Laplace Transform, Hopf-Cole Transform, Hodograph and Legendre Transforms, Potential Functions
4.	November	Unit IV	Asymptotics (Singular Perturbations, Laplace's Method, Geometric Optics, Stationary Phase, Homogenization), Power Series (Non-Characteristic Surfaces.
5.	December	Unit IV	Real Analytic Functions, Cauchy-Kovalevskaya Theorem)

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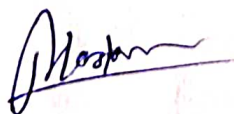## Department of Mathematics
Teaching Plan
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Class : M.Sc. III Semester

Subject : Mathematics

Paper : III (Programming In C (With ANSI Features) Theory And Practical)

S. No.	Month	Unit	
1.	July	Unit I	An Overview of Programming, Programming language, Classification, C Essentials-Program Development, Functions. Anatomy of a C Function. Variables and Constant,Expressions, Assignment Statements. Formatting Source Files. Continuation Character. The Preprocessor.
2.	August	Unit II	Scalar Data Types-Declarations, Different Types of Integers. Different Kinds of Integer Constants. Floation-Point Types. Initialization. Mixing Types. Explicit Conversions-Casts. Enumeration Types. The Void Data Type. Typedefs. Finding The Address of an Object. Ponters
3.	September	Unit III	Control Flow-Conditional Branching. The Switch Statement. Looping. Nested Loops. The break and Continue Statements. The goto statement. Infinite Loops. Arrays-Declaring an Array. Arrays and Memory. Initializing Arrays. Encryption and Decryption.
4.	October	Unit IV	Operators and Expressions-Precedence and Associativity. Unary Plus and Minus operators, Increment and Decrement Operators, Comma Operator, Relational Operator. Logical Operator. Bit-Manipulation Operator, Bitwise Assignment Operators.
5.	November	Unit IV	Cast Operator. Size of Operators. Conditional Operator. Memory Operators.

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Class : M.Sc. III Semester
Subject : Mathematics
Paper : IV (Operation Research (I))

S. No.	Month	Unit	
1.	July	Unit I	Operation Research and its Scope . Necessity of Operation Research in Industry. Linear Programming – Simplex Method. Theory of the Simplex Method. Duality and Sensitivity Analysis
2.	August	Unit II	Other Algorithms for Linear Programming – Dual Simplex Method. Parametric Linear Programming. Upper Bound Technique
3.	September	Unit III	Interior Point Algorithm. Linear Goal Programming, Transportation and Assignment Problems.
4.	October	Unit IV	Network Analysis – Shortest path Problem. Minimum Spanning Tree Problem. Maximum Flow I Problem. Minimum Cost Flow Problem
5.	November	Unit IV	Network Simplex Method. Project Planning and Control I with PERT-CPM.

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Class : M.Sc. III Semester

Subject : Mathematics

Paper : V (Fuzzy Sets and its Applications (I))

S. No.	Month	Unit	
1.	July	Unit I	Fuzzy Sets, basic definitions, alpha-level sets, convex fuzzy sets, Basic operations on fuzzy sets, Cartesian product. Algebraic products, bounded sum and difference ,
2.	August	Unit I Unit II	t-norms and t-conorms. Extension Principle- the Zadeh's extension principle, Image and inverse image of fuzzy sets. Fuzzy numbers. Elements of fuzzy arithmetic
3.	September	Unit III	Fuzzy relations and fuzzy graphs- Fuzzy relations on fuzzy sets, composition of fuzzy relations, min-max composition and its properties,
4.	October	Unit III	fuzzy equivalence relations, fuzzy compatibility relations, fuzzy relation equations, fuzzy graphs, similarity relation
5.	November	Unit IV	Possibility Theory, Fuzzy measure, evidence theory necessity measure, possibility measure, possibility distribution, possibility theory and fuzzy sets.
6	December	Unit IV	Possibility theory versus probability theory