DEPARTMENT OF MATHEMATICS

GOVERNMENT DEGREE COLLEGE, MENDHAR

(NAAC Accredited "B" Grade)

Programme Outcome of B.A./B.Sc. Mathematics.

- Create deep interest in learning mathematics.
- Develop broad and balanced knowledge and understanding of definitions, concepts, principles and theorems.
- Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
- A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
- Ability to analyze a problem, identify and define the computing requirements, which may be appropriate to its solution.
- Introduction to various courses like group theory, ring theory, field theory, metric spaces, number theory.
- Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- Ability to pursue advanced studies and research in pure and applied mathematical

Programme Specific Outcome of B.A./B.Sc. Mathematics.

- Think in a critical manner.
- Know when there is a need for information, to be able to identify, locate,
- Evaluate, and effectively use that information for the issue or problem at hand.
- Formulate and develop mathematical arguments in a logical manner.
- Students undergoing this programme learn to logically question assertions, to recognize patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing interdependent society.

- Completion of this programme will also enable the learners to join teaching profession in primary and secondary schools
- This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.
- Understand, formulate and use quantitative models arising in social science, Business and other contexts.

S.No.	Semester	Course Tittle	Course Code	Credits	Nature of the Course	Remarks, if any
1	I	Differential Calculus	UMTTC -101	06	Compulsory Core Course	-----
2	II	Differential Equation	UMTTC -101	06	Compulsory Core Course	------
3	III	Real Analysis	UMTTC -301	06	Compulsory Core Course	------
4	III	Logic and Sets	UMTTS-302	04	Skill Enhancement Course (SEC)	College opted to teach this course out of three optional skill courses
5	IV	Algebra	UMTTC -401	06	Compulsory Core Course	-------
6	IV	Vector Calculus	UMTTS -402	04	Skill Enhancement Course (SEC)	College opted to teach this course out of three optional skill courses
7	V	Matrices	UMTTE-501	06	Discipline Specific Elective (DSE)	College opted to teach one of these courses out of three optional DSE courses
8	V	Linear Algebra	UMTTE-503	06	Discipline Specific Elective (DSE)	
9	V	Probability and Statistics	UMTTS-504	04		College opted to teach this course out of three optional skill courses
10	VI	Numerical Methods	UMTTE-601	06	Discipline Specific Elective (DSE)	College opted to teach one of these courses out of three optional DSE courses
11	VI	Complex Analysis	UMTTE-602	06	Discipline Specific Elective (DSE)	
12	VI	Boolean Algebra	UMTTS-604	04	Skill Enhancement Course (SEC)	College opted to teach this course out of three optional skill courses

Title of the Course/ Course Number: - Differential Calculus (UMTTC-101)

Course Outcomes:-

After completion of course the students will be able to understand and discuss the concept of:-

- Limit and Continuity of functions on R (€ − δ definition).
- Algebra of limits. Discontinuity and types of discontinuities.
- Rate of change and Tangent to the curve.
- Successive differentiability; Leibnitz Theorem. Indeterminate forms
- Functions of several variables. Continuity of functions in two real variables.
- Partial differentiation, Euler's theorem for homogeneous functions.
- Maxima and Minima of functions of two variables. Concavity of functions.
- Asymptotes, Double points, Curvature, Envelope, Curve Tracing in Cartesian Co-Ordinates
- Polar Coordinates. Angle between radius vector and tangent to the curve. Graphic Techniques in Polar forms
- Rolle's Theorem, The Mean Value Theorems, Taylors Theorem with Lagrange's and Cauchy's form of remainder. Maclaurin's Series

Title of the Course/ Course Number:-Differential equation (UMTTC-102)

Course Outcomes

After completion of course the students will be able to understand and discuss the concept of:-

- Basic concept of differential equations.
- Application of differential equations.
- First order, higher degree differential equations solvable for x , y , p. Clairaut's equation. Exact and Non-Exact differential equations, Integrating factors and rules to find the integrating factor of a non-exact differential equation.
- Basic Theory of linear differential equations. Wronskian and its properties. Solving a differential equation by reducing its order. Linear homogeneous differential equations with constant coefficients.
- Linear non-homogeneous differential equations. The method of variation of parameters and the Cauchy-Euler equation.
- Introduction to partial differential equations, order and degree of a partial differential equation. Formation of partial differential equations. Types of partial differential equations. Lagranges method of solving linear partial differential equations of order one. Non-linear partial differential equations of degree one: Complete integral, Singular integral, General integral. Charpits methods
- Homogeneous and Non-homogeneous linear partial differential equations of second and third order with constant coefficients of different types.

Title of the Course/ Course Number: - Real Analysis (UMTTC-301)

Course Outcomes

After completion of course the students will be able to understand and discuss the concept of:-

- Finite and infinite sets, countable and uncountable sets.
- Absolute value, triangle inequality and its applications, bounded and unbounded sets, suprema and infima, axiomatic definition of real number system as a complete ordered field, least upper bound and greatest upper bound properties of reals, the field of rational numbers is not complete, characterization of suprema and infima of sets, Archimedean property, existence of rationals and irrationals between reals, concept of cluster points and statement of Bolzano-Weierstrass theorem.
- Real sequences and their boundedness, convergence and divergence, uniqueness of limit, algebra of limits, Cauchy convergence criterion, Cauchy's first and second theorem on limits, squeeze theorem, monotone convergence theorem, Nested-interval property of real numbers.
- Infinite series and their convergence and divergence, Cauchy's general principle of convergence, criterion for convergence of a series of positive terms, geometric series, p-series, comparison tests, D'Alembert's ratio test, Cauchy's root test, Raabe's test Gauss's test
- Cauchy's condensation test and convergence of , alternating series, absolute and conditional convergence
- Leibnitz's test, problems and exercises based on these topics. Some theorems on continuity and uniform continuity viz. every continuous function attains its bounds on closed and bounded interval, intermediate value theorem, continuity implies uniform continuity on closed intervals, relations between continuity and uniform continuity.
- Sequences and series of functions, point wise and uniform convergence, M_n-test, M-test, statements of the results about uniform convergence and integrability and differentiability of functions, power series and radius of convergence, problems and exercise based on these concepts.

Title of the Course/ Course Number: - Logic and Sets (UMTTS-302)

Course Outcomes

After completion of course the students will be able to understand and discuss the concept of:-

- Introduction, propositions, truth table, negation, conjunction and disjunction.
- Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.
- Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers,
- Binding variables and Negations.

- Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets.
- Finite sets and counting principle. Empty set, properties of empty set. Standard set operations.
- Classes of sets. Power set of a set.
- Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections.
- Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation.

Title of the Course/ Course Number: - Algebra (UMTTC-401).

Course Outcomes:-

After completion of course the students will be able to understand and discuss the concept of:-

- Binary operations, semi-groups and groups with plenty of examples from number system, matrices, functions, groups of symmetries of triangle, square etc.
- Abelian and non-abelian groups, finite groups, definition of group based on left and right axioms, order of an element of a group and results based on order of an element, permutation groups, even and odd permutations.
- Subgroups, their characterization, intersection, union and product of groups, subgroup generated by a subset, examples of subgroups including centre of a group, commutator subgroup of a group.
- characterization of an abelian group in terms of commutator subgroup.
- cyclic groups, their generators and properties.
- Cosets, their examples and properties, index of a subgroup, Langrange's theorem and its applications including Euler's theorem and Fermat's theorem, normal subgroups, their examples and characterization, quotient groups, results related to quotient groups like , is abelian or cyclic if G is so etc.
- Homomorphism and isomorphism of groups and their examples, kernel of a homomorphism, group of automorphisms, fundamental theorem of homomorphism including 2_{nd} and 3_{rd} laws of isomorphism, the set I(G) of all inner automorphisms is normal subgroup of A(G) the group of all automorphisms of group G and where C(G) is the centre of G, transformation groups and Cayley's theorem, cyclic groups upto isomorphism, examples and exercises based on these concepts.
- Concepts of Rings, integral domains and fields with plenty of examples, subrings, ideals and results based on these concepts, quotient ring, ring homomorphism and isomorphism, fundamental theorem of ring homomorphism, prime ideals, maximal ideals and their characterization, examples and exercises based on these concepts.

Title of the Course/ Course Number: - Vector Calculus (UMTTS-402)

Course Outcomes:-

After completion of course the students will be able to understand and discuss the concept of:-

- Differentiation and partial differentiation of a vector function.
- Derivative of sum, dot product and cross product of two vectors.
- Gradient, divergence and curl.

Title of the Course/ Course Number: - Matrices (UMTTE-501)

Course Outcomes:-

After completion of course the students will be able to understand and discuss the concept of:-

- Matrices: Symmetric, Skew- Symmetric, Hermitian, Skew- Hermitian, Unitary and Orthogonal. Rank of a matrix, characteristic polynomial of a matrix, eigen values, eigen vectors.
- Cayley – Hamilton theorem and its applications to find inverse of a matrix.
- Vector space. Concept of linear dependence and independence.
- Subspaces, different basis and dimension of these vector spaces. Exercises and results based on these concepts.
- Criterion for columns of a matrix are linearly dependent or linearly
- Rank of a matrix and its applications and results
- . Linear, homogenous and non-homogenous equations.
- Translation, dilation , rotation , reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.
- Diagonal form of matrices, reduction to diagonal form up to matrices of order 3.Solution of system of linear equations using matrices.

Title of the Course/ Course Number:- Linear Algebra (UMTTE-503)

Course Outcomes:-

After completion of course the students will be able to understand and discuss the concept of:-

- Definition and examples of vector spaces
- Sub spaces of a vector space and quotient space.
- Linear combination of vectors, linear span, linear dependence and linear independence of vectors.
- Basis and dimension,
- Finite dimensional vector space,

- Existence theorem, Extension theorem, Dimension theorem,
- Homomorphism and Isomorphism of vector spaces. Fundamental theorem of Homomorphism.
- Dual spaces of a finite dimensional vector space – Definitions and examples.Basis and dimension of Dual space
- Double dual of a vector space
- .Isomorphism between vector spaces and their double dual.
- Linear transformation on vector space and their examples, algebra of linear transformation on a vector space, Null space and range of linear transformation . Rank - Nullity theorem. Inverse of a linear transformation on finite dimensional vector space.
- Matrix representation of linear transformation.
- Matrices: Symmetric, Skew- Symmetric, Hermitian, Skew- Hermitian, Unitary and Orthogonal. Rank of a matrix, characteristic polynomial of a matrix, eigen values, eigen vectors. Cayley – Hamilton theorem and its applications.

Title of the Course/Course Number:- Probability and Statistics (UMTTS-504)

Course Outcomes:-

After completion of course the students will be able to understand and discuss the concept of:-

- Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions,.
- Mathematical expectation, moments, moment generating function,.
- Characteristic function, discrete distributions: uniform, binomial.
- Poisson, continuous distributions: uniform, normal, exponential.
- Joint cumulative distribution function and its properties,.
- joint probability density functions, marginal and conditional distributions.
- Expectation of function of two random variables, conditional expectations,independent random variables.

Title of the Course/ Course Number:- Numerical Methods (UMTTE-601)

Course Outcomes:-

After completion of course the students will be able to understand and discuss the concept of:-

- Finite Differences.
- Find the summation of series finite difference techniques
- Different operators and relation between them.
- Separation of symbols.
- Interpolation ,Newton's formula for Forward and Backward Interpolation, Lagrange's interpolation formula.
- Central Differences, Gauss Forward and Backward Interpolation formula.
- Sterling's formula, Bessel's formula.
- Numerical differentiation, forward , backward and central differences formulae for numerical

differentiation..

- Numerical Integration, Newton-Cotes Quadrature formula.
- Trapezodial rule, Simpson's ⅓ and ⅜ rule, Boole's rule ,
- Weddle,s rule ,
- Euler- Maclaurin's formula.
- Algorithms, Convergence, Bisection method,.
- Point iteration method, False position method, Secant method and Newton's method.
- Solution of simultaneous algebraic equations, Gauss elimination method, Gauss-Jordan method, Iterative methods.
- Jacobi method,.
- Gauss-Siebel method.

Title of the Course/ Course Number:- Complex Analysis (UMTTE-602)

Course Outcomes:-

After completion of course the students will be able to understand and discuss the concept of:-

- The complex plane, properties of complex numbers, polar representation .
- De- Moivre's theorem and its applications in finding the roots of complex numbers and in expressing powers of sine and cosine in terms of series of sine or cosine of multiples of **θ** and vice-versa.
- Functions of complex variables, exponential function.
- Logarithmic functions.
- Circular and hyperbolic functions of complex variables, relation between them and their properties .
- Summation of series of circular functions.
- Limits , Limits involving the point at infinity , continuity, regions in the complex plane , mapping and differentiability.
- Cauchy Riemann equations, sufficient condition for diffrentiability.
- Analytic functions, examples of analytic function.
- Definite integral of functions.
- Contours.
- Contour integral and its examples.
- Maximum Modulus.
- Principle.Cauchy-Goursat theorem.
- Cauchy Integral Formula.
- Liouville's theorem and the fundamental theorem of algebra.
- Convergence of sequences and series.
- Taylor Series.
- Absolute and uniform convergence of power series.

Title of the Course/ Course Number:- Boolean Algebra (UMTTS-604)

Course Outcomes:-

After completion of course the students will be able to understand and discuss the concept of:-

- Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle.
- Maximal and minimal elements, lattices as ordered sets, complete lattices, lattices as algebraic structures,
- Sublattices, products and homomorphisms.
- Definition, examples and properties of modular and distributive lattices,
- Boolean algebras.
- Boolean polynomials, minimal forms of Boolean polynomials,.
- Quinn-McCluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits.

Head
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Govt. Degree College
Mendhar

Source:-

1. Google Search Engine.
2. UGC official website.
3. University of Jammu, Jammu official Website.