

# Teaching Schedule

## Department of Mathematics

### ABV Govt Degree College Sunni, Shimla (H.P.)

#### BSc 1<sup>st</sup> Year

##### Core Courses

Course 1: **Differential Calculus (MATH101)**

Course 2: **Differential Equations (MATH102)**

Lectures per Week: 6

#### Course 1: Differential Calculus

Sr. No.	Topic	Week	Month
1.	Limit and Continuity (epsilon and delta definition),	Last Week	July
2.	Type of Discontinuities and Examples	First Week	August
3.	Differentiability of functions	Second week	August
4.	Successive differentiations and Leibnitz Theorem.	Third Week	August
5.	Indeterminant forms	Fourth Week	August
6.	Rolle's theorem, Lagrange Mean Value theorem and Cauchy Mean Value theorem	First Week	September
7.	Taylor series and Maclaurin series.	Second week	September
8.	Concavity, Convexity and Point of Inflexion.	Third Week	September
9.	Asymptotes, Curvature, Center of Curvature.	Fourth Week	September
10.	MTT	First Week	December
11.	MTT	Second Week	December
12.	Singular points, Double points	Third Week	December
13.	Polar coordinates, Relation between Cartesian and polar coordinates	Fourth Week	December
14.	Functions of several variables (upto three variables): Limit and Continuity of these functions, Partial differentiation	Second Week	February
15.	Euler's theorem on homogeneous functions.	Third Week	February
16.	Maxima and Minima with Lagrange Multipliers Method (two variables), Jacobian (upto three variables).	Fourth Week	February

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### Course 2: Differential Equations

Sr. No.	Topic	Week	Month
1.	Basic theory of linear differential equations, Wronskian, and its properties	1 <sup>st</sup> Week	October
2.	First order exact differential equations and their solutions, Integrating factor	2 <sup>nd</sup> Week	October
3.	Integrating factors, rules to find an integrating factor	3 <sup>rd</sup> Week	October
4.	First order higher degree equations solvable for x, y, p. Clairut's form.	4 <sup>th</sup> Week	October
5.	Methods for solving higher-order differential equations, Solving a differential equation by reducing its order.	1 <sup>st</sup> Week	November
6.	Linear homogenous equations with constant coefficients, Linear non-homogeneous Differential Equations	2 <sup>nd</sup> Week	November
7.	The method of variation of parameters with constant coefficients. The Cauchy-Euler equation and Legendre equation.	3 <sup>rd</sup> Week	November
8.	Simultaneous differential equations, Total differential equations	4 <sup>th</sup> Week	November
9.	MTT	First Week	December
10.	MTT	Second Week	December
11.	Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations. Formation of first order partial differential equations(PDE).	1 <sup>st</sup> Week	March
12.	Linear partial differential equation of first order, Lagrange's method and Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.	2 <sup>nd</sup> Week	March

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## BSc. 2<sup>nd</sup> Year

### *Core Courses*

Course 1: **Real Analysis (MATH201)**

Course 2: **Algebra (MATH202)**

Lectures per Week: 6

### **Course 1: Real Analysis**

<b>Sr. No.</b>	<b>Topic</b>	<b>Week</b>	<b>Month</b>
1.	Real line, bounded sets, suprema and infima.	Last Week	July
2.	suprema and infima, completeness property of $\mathbb{R}$ , Archimedean property of $\mathbb{R}$ , intervals.	First Week	August
3.	Concept of cluster points and statement of Bolzano-Weierstrass theorem.	Second week	August
4.	Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences.	Third Week	August
5.	Cauchy's theorem on limits, order preservation and squeeze theorem	Fourth Week	August
6.	monotone sequences and their convergence.	First Week	September
7.	Infinite series. Cauchy convergence criterion for series, positive term series, geometric series	Second week	September
8.	Leibnitz test, comparison test, convergence of p-series.	Third Week	September
9.	Root test, Ratio test, Definition and examples of absolute and conditional convergence.	Fourth Week	September
10.	MTT	First Week	December
11.	MTT	Second Week	December
12.	Topics not covered above	3 <sup>rd</sup> and 4 <sup>th</sup> Week	December
13.	Sequences and series of functions, Pointwise and uniform convergence.	2 <sup>nd</sup> Week	February
14.	Mn-test, M-test	3 <sup>rd</sup> Week	February
15.	Results about uniform convergence, Power series and radius of convergence	4 <sup>th</sup> Week	February

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### Course 2: Algebra

Sr. No.	Topic	Week	Month
1.	Definition and examples of groups, examples of abelian and non-abelian groups.	1 <sup>st</sup> Week	October
2.	The group $Z_n$ of integers under addition modulo $n$ and the group $U(n)$ of units under multiplication modulo $n$ . Cyclic groups from number systems, complex roots of unity.	2 <sup>nd</sup> Week	October
3.	Subgroups, cyclic subgroups	3 <sup>rd</sup> Week	October
4.	Cosets, Index of subgroup, Lagrange's theorem, order of an element.	4 <sup>th</sup> Week	October
5.	Normal subgroups: their definition, examples, and characterizations.	1 <sup>st</sup> Week	November
6.	Quotient groups and related theorems	2 <sup>nd</sup> Week	November
7.	Definition of Kernel, Basic theorems of homomorphism.	3 <sup>rd</sup> Week	November
8.	First theorem of Homomorphism and related questions.	4 <sup>th</sup> Week	November
9.	MTT	First Week	December
10.	MTT	Second Week	December
11.	Topics not covered above+ Definition and examples of rings, examples of commutative and non-commutative rings:	3 <sup>rd</sup> and 4 <sup>th</sup> Week	December
12.	Rings from number systems, $Z_n$ the ring of integers modulo $n$ . Rings of matrices, Definition of Integral domains and fields.	1 <sup>st</sup> Week	March
13.	Subrings and ideals	2 <sup>nd</sup> Week	March

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### Skill Enhancement Courses (2<sup>nd</sup> year)

Course 1: **Integral Calculus** (MATH309TH)

Course 2: **Vector Calculus** (MATH310TH)

Lectures per Week: 6

### Course 1: Integral Calculus

Sr. No.	Topic	Week	Month
1.	Integration by Partial fractions	First Week	August
2.	Integration of rational and irrational functions	Second week	August

3.	Properties of definite integrals	Third Week	August
4.	Reduction Formulae	Fourth Week	August
5.	Reduction by connecting two integrals (smaller index +1) method	First Week	September
6.	Areas and lengths of curves in the plane.	Second Week	September
7.	Volume and surface of solids of revolution.	Third Week	September
8.	Cartesian and parametric form.	Fourth Week	September
9.	Double integrals.	Second Week	February
10.	Triple integrals	Third Week	February

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### **Course 2: Vector Calculus**

<b>Sr. No.</b>	<b>Topic</b>	<b>Week</b>	<b>Month</b>
1.	Scalar and vector product of three vectors.	1 <sup>st</sup> Week	October
2.	Product of four vectors. Reciprocal vectors, Vector differentiation.	2 <sup>nd</sup> Week	October
3.	Scalar valued point functions, vector valued point functions. Derivative along a curve.	3 <sup>rd</sup> Week	October
4.	directional derivatives, Gradient of a scalar point function.	4 <sup>th</sup> Week	October
5.	Divergence and curl of a vector point function. Gradient, Divergence and curl of sums and products. Laplacian operator.	1 <sup>st</sup> Week	November
6.	Orthogonal curvilinear coordinates. Conditions for orthogonality	2 <sup>nd</sup> Week	November
7.	Fundamental triads of mutually orthogonal unit vectors. Gradient in terms of orthogonal curvilinear coordinators.	3 <sup>rd</sup> Week	November
8.	Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinators.	4 <sup>th</sup> Week	November
9.	MTT	First Week	December
10.	MTT	Second Week	December
11.	Vector integration: line integral, surface integral, Volume integral	4 <sup>th</sup> Week	February
12.	Theorems of Gauss, Green and Stokes (without proof) and the problems based on these theorems.	1 <sup>st</sup> Week	March

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### BSc. 3<sup>rd</sup> Year

#### **DISCIPLINE SPECIFIC ELECTIVES**

**DSE 3A: MATRICES (MATH301)**

**DSE 3B: NUMERICAL METHODS (MATH304)**

Lectures per Week: 6

#### **DSE 3A: MATRICES (MATH301)**

Sr. No.	Topic	Week	Month
1.	Types of matrices.	Last Week	July
2.	Rank of a matrix.	First Week	August
3.	Invariance of rank under elementary transformations. Reduction to normal form.	Second week	August
4.	Solutions of a system of linear equations using matrices.	Third Week	August
5.	Computation of matrix inverses using elementary row operations, Matrices in diagonal form.	Fourth Week	August
6.	Reduction to diagonal form upto matrices of order 3, Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.	First Week	September
7.	Definition of Vector space, $R$ , $R^2$ , $R^3$ as vector spaces over $R$	Second Week	September
8.	Vector subspaces and concept of Linear dependence/Independence	Third Week	September
9.	Bases and Dimension of a vector space.	Fourth Week	September
10.	MTT	First Week	December
11.	MTT	Second Week	December
12.	Translation, Dilation, Rotation, Reflection in a point, line and plane, Matrix form of basic geometric transformations.	Second Week	February
13.	Interpretation of eigenvalues and eigen vectors for such transformations and eigen spaces as invariant subspaces.	Third Week	February

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**DSE 3B: NUMERICAL METHODS (MATH304)**

Sr. No.	Topic	Week	Month
1.	Algorithms, Convergence, Bisection method.	1 <sup>st</sup> Week	October
2.	False position method, secant method, Fixed point iteration method.	2 <sup>nd</sup> Week	October
3.	Newton's method, LU decomposition.	3 <sup>rd</sup> Week	October
4.	Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.	4 <sup>th</sup> Week	October
5.	Lagrange and Newton interpolation: linear and higher order.	1 <sup>st</sup> Week	November
6.	Finite difference operators,	2 <sup>nd</sup> Week	November
7.	Numerical differentiation: Newton's forward difference formula, Newton's backward difference formula.	3 <sup>rd</sup> Week	November
8.	Sterling's Central difference method	4 <sup>th</sup> Week	November
9.	MTT	First Week	December
10.	MTT	Second Week	December
11.	Topics not covered above	3 <sup>rd</sup> and 4 <sup>th</sup> Week	December
12.	Integration: Trapezoidal rule.	4 <sup>th</sup> Week	February
13.	Simpson's rule, Euler's method.	1 <sup>st</sup> Week	March

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**Skill Enhancement Courses (Bsc 3<sup>rd</sup> Year)**

Course 1: **PROBABILITY AND STATISTICS (MATH313)**

Course 2: **TRANSPORTATION AND GAME THEORY (MATH317)**

Lectures per Week: 6

**Course 1: Probability and Statistics**

Sr. No.	Topic	Week	Month
1.	Sample space, probability axioms, real random variables (discrete and continuous),	First Week	August
2.	cumulative distribution function, probability mass/density functions.	Second week	August
3.	Mathematical expectation, moments	Third Week	August
4.	moment generating function, characteristic function	Fourth Week	August
5.	Joint cumulative distribution function and its properties, joint probability density functions,	First Week	September
6.	marginal and conditional distributions,	Second Week	September

7.	expectation of function of two random variables	Third Week	September
8.	conditional expectations, independent random variables	Fourth Week	September
9.	discrete distributions: uniform, Binomial, Poisson.	Second Week	February
10.	continuous distributions: uniform, normal, exponential.	Third Week	February

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### **Course 2: Transportation and Game theory**

<b>Sr. No.</b>	<b>Topic</b>	<b>Week</b>	<b>Month</b>
1.	Transportation problem and its mathematical formulation, northwest-corner method.	1 <sup>st</sup> Week	October
2.	least cost method, Vogel approximation method for determination of starting basic solution	2 <sup>nd</sup> Week	October
3.	algorithm for solving transportation problem (Modi method).	3 <sup>rd</sup> Week	October
4.	Questions for optimal solution of transportation problems under degenerate cases.	4 <sup>th</sup> Week	October
5.	Assignment problem and its mathematical formulation	1 <sup>st</sup> Week	November
6.	Hungarian method for solving assignment problem	2 <sup>nd</sup> Week	November
7.	Game theory: formulation of two-person zero sum games	3 <sup>rd</sup> Week	November
8.	Questions related to 2 by 2 matrix games	4 <sup>th</sup> Week	November
9.	MTT	First Week	December
10.	MTT	Second Week	December
11.	solving two-person zero sum games, games with mixed strategies	4 <sup>th</sup> Week	February
12.	graphical solution procedure.	1 <sup>st</sup> Week	March

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