

HIMALAYAN GARHWAL UNIVERSITY

Uttrakhand

COURSE STRUCTURE FOR

Bachelor of Arts- MATHS

(B.A. MATHS)

SEMESTER SYSTEM

Syllabus - B.A. MATHS

Course **Marks Evaluation**

Paper Code	Paper Name	Internal Marks	External Marks	Total Marks
Year - I				
BAMT101	Differential Calculus	30	70	100
BAMT102	Differential Equations	30	70	100
Total		60	140	200
Year - II				
Paper Code	Paper Name	Internal Marks	External Marks	Total Marks
BAMT201	Real Analysis	30	70	100
BAMT202	Algebra	30	70	100
Total		60	140	200
Year - III				
Paper Code	Paper Name	Internal Marks	External Marks	Total Marks
BAMT301	Matrices	30	70	100
BAMT302	Numerical Methods	30	70	100
Total		60	140	200

YEAR-I

BAMT101: Differential Calculus

Unit—1

Limit and Continuity (ϵ and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz' s theorem, Partial differentiation, Euler's theorem on homogeneous functions.

Unit-2

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of' curves. Parametric representation of' curves and tracing of' parametric curves, Polar coordinates and tracing of curves in polar coordinates.

Unit-3

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

Books Recommended

1. I. Anton, I. Bivens and S. Davis, Calculus, John Wiley and Sons, Inc., 2011.
2. G.B. Thomas and R.L.. Finney, Calculus, Pearson Education, 2007.

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BAMT102 Differential Equations

Unit-1

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher-degree equations solvable for x , y , p . Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order.

Unit-2

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters. The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

Unit-3

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Suggested Readings:

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

YEAR-II

BAMT201 Real Analysis

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of \mathbb{R} , Archimedean property of \mathbb{R} , intervals, Concept of cluster points and statement of Bolzano-Weierstrass theorem.

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence. Sequences and series of functions, Pointwise and uniform convergence. Mn-test, M-test.

Books Recommended

1. T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis*. John Wiley and Sons (Asia) P. Ltd., 2000.
3. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series-* Undergraduate Texts in Mathematics, Springer Verlag, 2003.

BAMT 202 Algebra

Definition and examples of groups, examples of abelian and non-abelian groups, the group \mathbb{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, circle group, the general linear group $GL_n(n, \mathbb{R})$, groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group $Sym(n)$, Group of quaternions.

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, \mathbb{Z}_n the ring of integers modulo n , ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions. Subrings and ideals, Integral domains and fields, examples of fields: \mathbb{Z}_p , \mathbb{Q} , \mathbb{R} , and \mathbb{C} .

Books Recommended

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.
4. George E Andrews, *Number Theory*, Hindustan Publishing Corporation, 1984.

YEAR- III

BAMT301 Matrices

R , R^2 , R^3 as vector spaces over R . Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of R^2 , R^3 .

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.

Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four.

Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices.

Books Recommended

1. A.I. Kostrikin, *Introduction to Algebra*, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, *Linear Algebra*, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Richard Bronson, *Theory and Problems of Matrix Operations*, Tata McGraw Hill, 1989.

BAMT 302 Numerical Methods

Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.

Lagrange and Newton interpolation: linear and higher order, finite difference operators. Numerical differentiation: forward difference, backward difference and central Difference. Integration: trapezoidal rule, Simpson's rule, Euler's method.

Recommended Books

1. B. Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 5th Ed., New age International Publisher, India, 2007.