DEPARTMENT OF MATHEMATICS
MGS UNIVERSITY, Bikaner

B.Sc. / B.A. Mathematics

Examinations 2024, 2025 & 2026

Sem	Paper Code	Paper Name	Code	L	T	P	Total Credits	Maximum Marks			Minimum Pass %
								Internal	External	Total	
I	MAT 4.5 Th 1	Algebra	DCC	9	0	0	6	30	120	150	36%
II	MAT 4.5 Th 2	Calculus	DCC	9	0	0	6	30	120	150	36%
III	MAT 5.0 Th 1	Higher Calculus	DCC	9	0	0	6	30	120	150	36%
IV	MAT 5.0 Th 2	Differential Equations	DCC	9	0	0	6	30	120	150	36%
V	MAT 5.5 Th 1	Ring Theory and Vector Spaces	DCC	9	0	0	6	30	120	150	36%
VI	MAT 5.5 Th 2	Analysis	DCC	9	0	0	6	30	120	150	36%

B.A./B.Sc. Semester I

Paper Code	Paper Name	Code	L	T	P	Total Credits	Maximum Marks			Minimum Pass %
							Internal	External	Total	
MAT 4.5 Th 1	Algebra	DCC	9	0	0	6	30	120	150	36%

Note : The paper is assigned 9 teaching hours per week.

Algebra

The question paper shall contain three sections.

Section A (20 marks) shall contain 10 questions two from each Unit. Each question shall be of 2 marks. All the questions are compulsory.

Section A will be prepared such that questions i through v are multiple-choice questions, while questions vi through x will be fill-in-the-blank questions.

Section B (40 marks) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 8 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words.

Section C (60 marks) shall contain 5 questions, one from each Unit. Each question shall be of 20 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

Unit - I

Relation between roots and coefficients of general polynomial equation in one variable, transformation of equations, Descartes' rule of signs, Solution of Cubic equations (Cardono's Method) Biquadratic Equations(Ferrari Method).

Unit - II

Symmetric, Skew symmetric. Hermitian and skew Hermitian matrices. Linear Independence of row and column matrices. Row rank, Column rank, Rank of a matrix by Echelon form, the characteristic equation of a matrix and eigenvectors. Cayley Hamilton theorem and its use in finding inverse of a matrix. Applications of matrices to a system of linear (both homogenous and non-homogenous) equations. Theorems of consistency of a system of linear equations.

Unit - III

Definitions and examples of groups, general properties of groups, subgroups, cyclic groups, cosets decomposition, Lagrange's theorem and its consequences, Fermat's and Euler's theorems.

Unit - IV

Homomorphism and isomorphism of groups, normal subgroups, quotient groups. The fundamental theorem of homomorphism. Kernel of homomorphism and its properties.

Unit - V

Permutations groups, even, odd and cyclic permutations, transpositions, the alternating group-An , Conjugacy, and simple groups. Cayley's theorem. Order of an element of a group and its properties.

REFERENCE BOOKS:

- Chandrika Prasad :The Text Book of Algebra and Theory of Equations, Pothishala Pvt Ltd. Allahabad.
- Vashitha, A.R. :Modern Algebra, Krishna PrakashnaMandir, Meerut
- Gokhroo et. Al. :Matrices (Hindi Ed.) NavkarPrakashan, Ajmer
- Gokhroo et. Al. :Group Theory (English/Hindi Ed.) Navkar Prakashan, Ajmer.
- P.B. Bhattacharya and Others :Basic Abstract Algebra (2^{nd} Edition) Camb. University Press Indian Edition,1997
- I. N. Herstein :Topics in Algebra Wiley Eastern Ltd. New Delhi (1975)
- Bansal, Bhargava & Agarwal :Abstract Algebra, Jaipur Publishing House, Jaipur

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B.A./B.Sc. Semester II

Paper Code	Paper Name	Code	L	T	P	Total Credits	Maximum Marks			Minimum Pass %
							Internal	External	Total	
MAT 4.5 Th 2	Calculus	DCC	9	0	0	6	30	120	150	36%

Note : The paper is assigned 9 teaching hours per week.

Calculus

The question paper shall contain three sections.

Section A (20 marks) shall contain 10 questions two from each Unit. Each question shall be of 2 marks. All the questions are compulsory.

Section A will be prepared such that questions i through v are multiple-choice questions, while questions vi through x will be fill-in-the-blank questions.

Section B (40 marks) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 8 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words.

Section C (60 marks) shall contain 5 questions, one from each Unit. Each question shall be of 20 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

Unit - I

Pedal equation of a curve,Envelope and Evolutes, Asymptotes, Curvature: Various Formulae, centre of curvature, chord of curvature and related problems.

Unit - II

Partial differentiation, chain of variables, Euler's theorem on homogeneous functions, first two differential coefficients of an implicit functions. Taylor's theorem for functions of two variables, Jacobians with properties.

Unit - III

Maximum – Minimum and saddle points of functions of two and three variables connected by a relation. Lagrange's method of undermined multipliers. Test of concavity and convexity, points of inflexion, multiple points, curve tracing in Cartesian and polar coordinates (standard curves).

Unit - IV

Differentiation and Integration under the sign of integration, Beta and Gamma functions, double integrals, change of order of integration, transformation in polar coordinates.

Unit - V

Quardrature, rectification, volume and surface of solid of revolution. Triple integrals. Dirichlet's integrals and Liouville's extension.

REFERENCE BOOKS:

1. Gorakh Prasad :Text Book of Differential calculus, Pothishala Pvt. Ltd. Allahabad
2. Gorakh Prasad :Text Book of Integral calculus, Pothishala Pvt. Ltd. Allahabad
3. N. Piskunov :Differential and Integral calculus, Peace Publications, Moscow
4. Gokhrooet. al. :Differential Calculus (English/Hindi Ed.) Navkar Prakashan, Ajmer.
5. Gokhrooet. al. :Integral Calculus (English/Hindi Ed.) Navkar Prakashan, Ajmer.
6. Erwin Kreyszig :Advance Engineering Mathematics Johm Willey and sons 1999

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B.A./B.Sc. Semester III

Paper Code	Paper Name	Code	L	T	P	Total Credits	Maximum Marks			Minimum Pass %
							Internal	External	Total	
MAT 5.0 Th 1	Higher Calculus	DCC	9	0	0	6	30	120	150	36%

Note : The paper is assigned 9 teaching hours per week.

Higher Calculus

The question paper shall contain three sections.

Section A (20 marks) shall contain 10 questions two from each Unit. Each question shall be of 2 marks. All the questions are compulsory.

Section A will be prepared such that questions i through v are multiple-choice questions, while questions vi through x will be fill-in-the-blank questions.

Section B (40 marks) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 8 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words.

Section C (60 marks) shall contain 5 questions, one from each Unit. Each question shall be of 20 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

Unit - I

Limit ε-δ definition of the limit of a function, Limit of functions of one and two variables, Continuity, classification of discontinuities, Sequential continuity, Properties of continuous functions, Uniform continuity, Continuity of functions of two variables.

Unit - II

Differentiability, Chain rule of differentiability, Differentiability of functions of two variables, Darboux's intermediate value theorem for derivatives, Mean Value Theorems and their geometrical interpretations, Taylor's theorem with various forms of remainders, Taylor's theorem for functions of two variables.

Unit - III

Riemann integral, Partition, Darboux sums, Lower and Upper integrals, Integrability of continuous and monotonic functions. the fundamental theorem of Integral Calculus, Mean value theorems of Integral Calculus.

Unit - IV

Real sequence, definition, Theorems on limits of sequences, Bounded and monotonic sequences, Cauchy's convergence criterion.

Infinite Series of non negative terms, Comparison tests, Cauchy's n^{th} root test, Ratio tests, Raabe's, logarithmic, De Morgan and Bertrand's tests Alternating series, Leibniz theorem, Absolute and conditional convergence.

Unit – V

Uniform convergence of series of functions, Weierstrass M-test, Abel's and Dirichlets test for uniform convergence. **Improper integrals** and their convergence, Comparison tests, Abel's and Dirichlet's tests, **Fourier Series**, Fourier expansion of piecewise monotonic functions.

REFERENCE BOOKS:

1. Real Analysis : Shanti Narayan
2. Real Analysis : G. N. Purohit
3. Real Analysis : Bhargava & Goyal
4. Advanced Calculus : Gokhroo et. al. (English / Hindi Ed.)
5. Theory of Convergence: Gokhroo et. al. (English / Hindi Edn.) Navkar Prakashan, AJMER

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B.A./B.Sc. Semester IV

Paper Code	Paper Name	Code	L	T	P	Total Credits	Maximum Marks			Minimum Pass %
							Internal	External	Total	
MAT 5.0 Th 2	Differential Equations	DCC	9	0	0	6	30	120	150	36%

Note : The paper is assigned 9 teaching hours per week.

Differential Equations

The question paper shall contain three sections.

Section A (20 marks) shall contain 10 questions two from each Unit. Each question shall be of 2 marks. All the questions are compulsory.

Section A will be prepared such that questions i through v are multiple-choice questions, while questions vi through x will be fill-in-the-blank questions.

Section B (40 marks) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 8 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words.

Section C (60 marks) shall contain 5 questions, one from each Unit. Each question shall be of 20 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

Unit - I

Degree and order of differential equations, Equations of first order and first degree, Equations in which the variables are separable, Homogeneous equations, Linear equations and equations reducible to the linear form, Exact differential equations, Integrating Factors, First order and higher degree equations solvable for x, y, p, Clairaut's form and Singular solutions, Geometrical meaning of a differential equation, Orthogonal trajectories.

Unit - II

Linear differential equations with constant coefficients, Homogeneous Linear ordinary differential equations, Ordinary simultaneous differential equations, Total differential equations.

Unit - III

Linear differential equations of Second order, Transformation of the equation by changing dependent variable/the independent variable. Methods of variation of parameters.

Series solution of differential equations, Power series method, Bessel, Legendre and Hyper geometric equations, Bessel, Legendre and Hyper geometric functions and their properties.

Unit - IV

Partial differential equations of the first order, Lagrange's solution, Some special type of equations which can be solved easily by methods other than the general method, Charpit's general method of solution.

Unit - V

Partial Differential equations of second order and higher orders, Classification of linear Partial differential equations of second order, Homogeneous and non homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Monge's methods.

REFERENCE BOOKS:

1.	Differential Equations	:	Ray and Chaturvedi
2.	Differential Equations	:	Sharma and Gupta
3.	Differential Equations	:	Bansal and others
4.	Ordinary Differential Equations	:	Gokhroo et. al. (English / Hindi Ed.)
5.	Partial Differential Equations	:	Gokhroo et.al. (English / Hindi Edn.) Navkar Prakashan, Ajmer

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B.A./B.Sc. Semester V

Paper Code	Paper Name	Code	L	T	P	Total Credits	Maximum Marks			Minimum Pass %
							Internal	External	Total	
MAT 5.5 Th 1	Ring Theory and Vector Spaces	DCC	9	0	0	6	30	120	150	36%

Note : The paper is assigned 9 teaching hours per week.

Ring Theory and Vector Spaces

The question paper shall contain three sections.

Section A (20 marks) shall contain 10 questions two from each Unit. Each question shall be of 2 marks. All the questions are compulsory.

Section A will be prepared such that questions i through v are multiple-choice questions, while questions vi through x will be fill-in-the-blank questions.

Section B (40 marks) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 8 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words.

Section C (60 marks) shall contain 5 questions, one from each Unit. Each question shall be of 20 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

Unit - I

Introduction to Rings, Zero divisors, Integral Domain and Fields, their examples and properties. Characteristic of a ring and integral domain. Sub rings, subfields, Prime field, Ring homomorphism, Embedding of Rings, Field of quotients of an integral domain.

Unit- II

Ideals and their properties. Principal ideal and principal ideal ring, Prime ideal, Maximal ideal. Ideals and Quotient rings, Euclidean rings, Unique Factorization Domain, Polynomial rings, Remainder theorem, factor theorem, Polynomials over the rational fields.

Unit - III

Vector Spaces : Definition and examples of a vector spaces, subspaces, sum and direct sum of subspaces, linear span, linear dependence, Independence and their basic properties, Basis, finite dimensional vector spaces, Existence theorem for basis, invariance of the number of elements of a basis set, Dimension, existence of complimentary subspace of a subspace of a finite dimensional vector space, dimension of sums of subspaces, quotient space and its dimension.

Unit - IV

Linear transformations : Linear Transformations and their representation as matrices, the algebra of linear transformations, the Rank-Nullity theorem, change of basis, Dual space, Dual Basis, Bidual space, Adjoint of a linear transformation, Annihilator of a sub space.

Unit - V

Eigen values and Eigen vectors, similar matrices, equivalent matrices, Similarity of Linear transformations, Reduction to triangular form, Minimal Polynomial. Diagonalisation of Matrices.

REFERENCE BOOKS:

1. I.N. Herstein : Topics in Algebra
2. Lang, S. : Linear Algebra
3. Hoffman & Kunz : Linear Algebra
4. A.R. Vashistha : Modern Algebra
5. Gokhroo et. al. : Ring Theory (English / Hindi Edn.)
6. Gokhroo et. al. : Linear Algebra (English / Hindi Edn.)

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B.A./B.Sc. Semester VI

Paper Code	Paper Name	Code	L	T	P	Total Credits	Maximum Marks			Minimum Pass %
							Internal	External	Total	
MAT 5.5 Th 2	Analysis	DCC	9	0	0	6	30	120	150	36%

Note : The paper is assigned 9 teaching hours per week.

Analysis

The question paper shall contain three sections.

Section A (20 marks) shall contain 10 questions two from each Unit. Each question shall be of 2 marks. All the questions are compulsory.

Section A will be prepared such that questions i through v are multiple-choice questions, while questions vi through x will be fill-in-the-blank questions.

Section B (40 marks) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 8 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words.

Section C (60 marks) shall contain 5 questions, one from each Unit. Each question shall be of 20 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

Unit - I

Real Number System as a complete Ordered Field.

The point set theory, Open and Closed sets, Limit point of a set, Neighborhood, Bolzano-Weierstrass theorem, Heine-Borel theorem, Compactness, connectedness, Cantor's ternary set.

Unit - II

Definition and example of a metric space, Diameter of a set, Bounded set, Open sphere, Interior point and Interior of a set, Derived and Closure of set, Closed set, Closed Sphere, Properties of Open and Closed sets, Boundary point of set, Convergent and Cauchy sequences, complete metric space, Cantor's Intersection theorem. Dense subset, Baire Category theorem.

Unit - III

Limit of a function, Continuous function, theorem on necessary and sufficient conditions for continuity of a function, Uniform continuity, Contracting mapping, Banach Fixed Point theorem, Equivalent matrices, Compactness, Sequentially compactness, Totally Bounded space, Finite Intersection properties.

Unit - IV

Complex Numbers as ordered pairs, Complex plane, Geometrical representation, Connected and compact sets, Curves and region in the complex plane, Statement of Jordan curves theorem, Extended complex plane and stereographic projection, Complex valued functions limits, Convergence, continuity, Differentiailbility in the extended plane, Analytic functions. Cauchy-Reimann equations (Cartesian & Polar forms).

Unit - V

Harmonic functions, Construction of an analytic function, conformal mapping, Bilinear transformation, Fixed point, Inverse point, Elementary maps. $F(z) = 1/2\ (z+1/z)$, z^2, $2z$, sinz and logz

REFERENCE BOOKS:

1. Shanti Narain : Complex Variables, S. Chand, New Delhi.
2. Gupta, KP : Complex Analysis
3. Sharma J.N. : Metric Spaces, Krishna Prakashan Mandir, Meerut.
4. Gokhroo et.al. : Metric Spaces (English / Hindi Edn.)
5. Gokhroo et.al. : Complex Analysis (English / Hindi Edn.) Navkar Publications, Ajmer.