

JIWAJI UNIVERSITY, GWALIOR
B.Sc. Honor's Mathematics – 2019-22

Subject – Mathematics

Year – 2019-2022

| Year | Type of Paper | Paper Code | Name of the Paper | Marks | | |
|----------|------------------|------------|--|-------|-------------|-------|
| | | | | CCE | Yearly Exam | Total |
| I Year | Pass Course I | Math-101 | Algebra & Trigonometry | 10 | 40 | 50 |
| | Pass Course II | Math-102 | Calculus and Differential Equations | 10 | 40 | 50 |
| | Pass Course III | Math-103 | Abstract Algebra | 10 | 40 | 50 |
| | Honor's Course-I | Math-104 | | 10 | 40 | 50 |
| II Year | Pass Course I | Math-201 | Advanced Calculus | 10 | 40 | 50 |
| | Pass Course II | Math-202 | Differential Equations | 10 | 40 | 50 |
| | Pass Course III | Math-203 | Vector Analysis and Geometry | 10 | 40 | 50 |
| | Honor's Course-I | Math-204 | | 10 | 40 | 50 |
| | Honor's Course-I | Math-205 | | 10 | 40 | 50 |
| III Year | Pass Course I | Math-301 | Linear Algebra and Numerical Analysis | 10 | 40 | 50 |
| | Pass Course II | Math-302 | Real and Complex Analysis | 10 | 40 | 50 |
| | Pass Course III | Math-303 | Optional (Any One) 1.Discrete Mathematics 2.Statistical Methods | 10 | 40 | 50 |
| | Honor's Course-I | Math-304 | | 10 | 40 | 50 |
| | Honor's Course-I | Math-305 | | 10 | 40 | 50 |
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JIWAJI UNIVERSITY,

GWALIOR.

B.Sc-I Year (Pass Course)

Academic Session : 2019-2022

| Paper Number & Title of the Paper | Paper-wise Maximum Marks | Total Theory Marks | Internal Assesment Maximum Marks | Total |
|---|--------------------------|--------------------|----------------------------------|-------|
| Math 101-Algebra and Trigonometry | 40 | 120 | 10 | 150 |
| Math102-Calculus and Differential Equations | 40 | | 10 | |
| Math103- Abstract Algebra | 40 | | 10 | |


Nalin Divalani

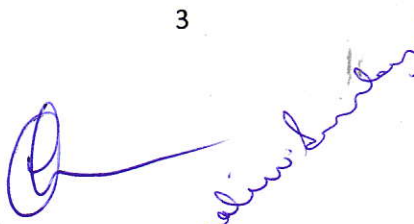
JIWAJI UNIVERSITY, GWALIOR
B.Sc. Honor's Mathematics : 2019-22

| | |
|---------------|-----------------------------------|
| Class | B.Sc. I Year |
| Paper | Math- 101: Algebra & Trigonometry |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

| | |
|--------|---|
| Unit-1 | Rank of a matrix, Normal & Echelon form of a matrix. Characteristic equations of a matrix, Eigen values, Eigen vectors, Linear Independence of row and column matrix. |
| Unit-2 | Cayley Hamilton theorem and its use in finding inverse of a matrix, application of matrix to solve a system of linear (homogenous and non-homogenous) equations, theorems on consistency and inconsistency of a system of linear equations, solving linear equations upto three unknowns. |
| Unit-3 | Relation between the roots and coefficients of a general polynomial equation in one variable, transformation of equations, Reciprocal equations, Descarte's rule of signs. |
| Unit-4 | Logic- Logical connectives, Truth Tables, Tautology, Contradiction, Logical Equivalence, Algebra of propositions, Boolean Algebra- definition and properties, Boolean Functions, switching circuits and its applications, logic gates and circuits. |
| Unit-5 | De- Moivre's theorem and its application, direct and inverse circular and hyperbolic functions, expansion of trigonometric functions, logarithm of complex quantities, Gregory's series, summation of trigonometrical series. |

Text Books:

1. S.L. Loney - Plane Trigonometry Part-II.
2. K.B. Datta - Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi 2000.
3. Chandrika Prasad - A Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd. Allahabad.
4. C.L. Liu - Elements of Discrete Mathematics (Second Edition), McGraw Hill, International Edition, Computer Science Series, 1986.



Reference Books:

1. H.S. Hall and S.R. Knight- Higher Algebra H.M. Publication, 1994.
2. N. Jacobson- Basic Algebra Vol. I and II, W.H. Freeman.
3. N. Saran and R.S. Gupta- Analytical Geometry of Three Dimension, Pothishala Pvt. Ltd. Allahabad.

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JIWAJI UNIVERSITY, GWALIOR
B.Sc. Honor's Mathematics : 2019-22

| | |
|---------------|--|
| Class | B.Sc. I Year |
| Paper | Math- 102: Calculus and Differential Equations |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

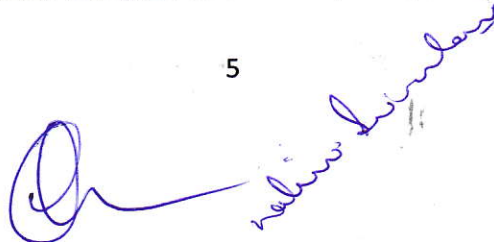
| | |
|--------|---|
| Unit-1 | Successive differentiation, Leibnitz theorem, Maclaurin's and Taylor's series expansions, Asymptotes. |
| Unit-2 | Curvature, tests for concavity and convexity, points of inflexion, multiple points, tracing of curves in cartesian and polar coordinates. |
| Unit-3 | Integration of transcendental functions, Definite Integrals, Reduction formula, Quadrature, Rectification. |
| Unit-4 | Linear differential equations and equations reducible to the linear form, Exact differential equations, first order and higher degree equations solvable for x, y and p. Clairaut's equation and singular solutions, geometrical meaning of a differential equation, Orthogonal trajectories. |
| Unit-5 | Linear differential equation with constant coefficients, Homogeneous linear ordinary differential equations, Linear differential equations of second order, transformation of equations by changing the dependent variable/ independent variable, method of variation of parameters. |

Text Books:

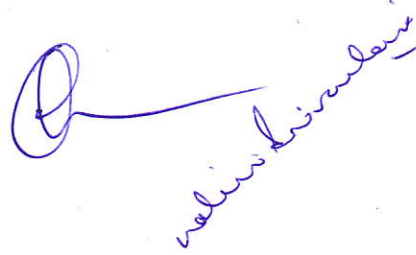
1. Gorakh Prasad - Differential Calculus, Pothishala Pvt. Ltd. Allahabad.
2. Gorakh Prasad - Integral Calculus, Pothishala Pvt. Ltd. Allahabad.
3. D. A. Murray- Introductory Course in Differential Equations. Orient Longman (India) 1967.

Reference Books:

1. G.F. Simmons - Differential Equations, Tata McGraw Hill, 1972.
2. E.A. Codington - An Introduction to ordinary differential Equation, Prentice Hall of India, 1961.



3. H.T.H. Piaggio - Elementary Treatise on Differential Equations and their Application, C.B.S. Publisher & Distributors, Delhi, 1985.
4. S.G. Deo - Differential Equations, Narosa Publishing House, 2015.
5. N. Piskunov - Differential and Integral Calculus, Peace Publishers, Moscow.

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JIWAJI UNIVERSITY, GWALIOR
B.Sc. Honor's Mathematics : 2019-22

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|---------------|-----------------------------|
| Class | B.Sc. I Year |
| Paper | Math- 103: Abstract Algebra |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

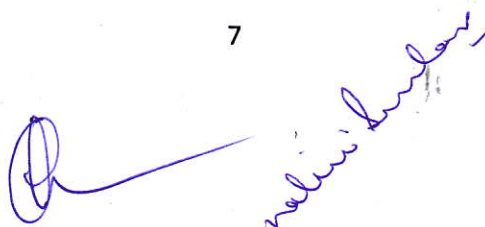
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|--------|--|
| Unit-1 | Definition and basic properties of groups, subgroups, subgroups generated by a subset, Cyclic groups and simple properties. |
| Unit-2 | Coset decomposition, Lagrange's theorem and its corollaries including Fermat's theorem, Normal sub groups, Quotient groups. |
| Unit-3 | Homomorphism and Isomorphism of groups. Fundamental theorem of homomorphism. Transformation and Permutation group, S_n (various subgroups of S_n , $n < 5$ to be studied), Cayley's theorem. |
| Unit-4 | Group Automorphism, Inner Automorphism, group of Automorphisms, Conjugacy relation and Centraliser, Normaliser, Counting principal and class equation of a finite group, Cauchy's theorem for finite abelian groups and non-abelian groups. |
| Unit-5 | Definition and basic properties of rings, Ring homomorphism, subrings, Ideals and Quotient rings, Polynomial rings & its properties, Integral domain, Principal ideal domains, Euclidean domains and unique factorization domains, Field and quotient field. |

Text books:

1. I.N.Herstien- Topics in Algebra. Wiley Eastern Ltd. New Delhi, 1997.
2. PB Bhattacharya, S.K. Jain and S R Nagpaul-Basic Abstract Algebra. Wiley Eastern, New Delhi, 1997.

Reference Books:

1. Shantinayakan- A Text Book of modern Abstract Algebra, S. Chand and company,



New Delhi.

2. Surjeet Singh- A text book of Modern Algebra.
3. N. Jacobson- Basic Algebra, Vol. I and II, W. H. Freeman.
4. I. S. Luther and I.B.S. Passi- Algebra, Vol. I and II, Narosa Publishing House.

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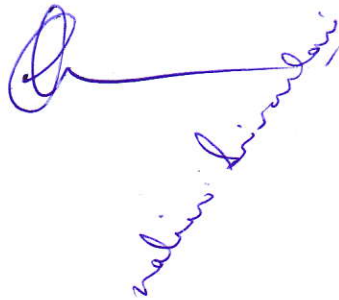
JIWAJI UNIVERSITY,

GWALIOR.

B.Sc-II Year (Pass Course)

Academic Session : 2019-2022

| Paper Number & Title of the Paper | Paper-wise Maximum Marks | Total Theory Marks | Internal Assesment Maximum Marks | Total |
|---|-----------------------------|--------------------------|--|-------|
| Math201-Advanced Calculus | 40 | 120 | 10 | 150 |
| Math202-Differential Equations | 40 | | 10 | |
| Math203-Vector Analysis and Geometry | 40 | | 10 | |



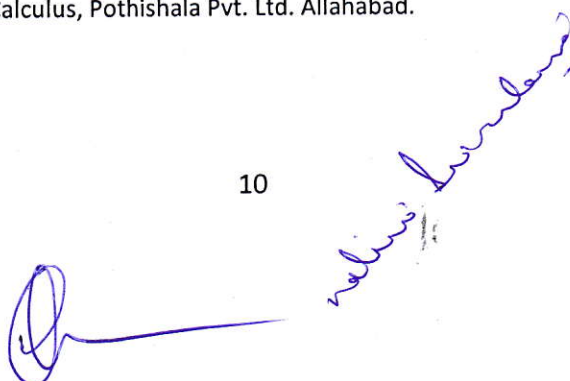
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|----------------------|-------------------------------------|
| Class | B.Sc. II Year |
| Paper | Math- 201: Advanced Calculus |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

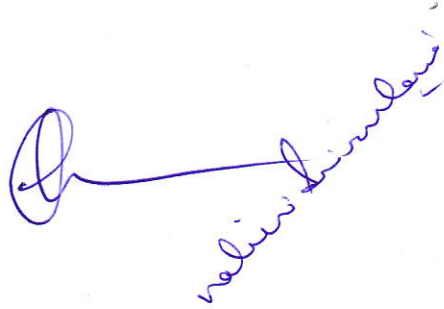
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|---------------|--|
| Unit-1 | Definition of a sequence, Theorems on limits of sequences, indeterminate forms. Bounded and monotonic sequences. Cauchy's convergence criterion, series of non- negative terms, comparison test, Cauchy's integral test, Cauchy's root test, ratio tests, Raabe's tests, logarithmic tests, Alternating series, Leibnitz's tests, Absolute and conditional convergence, absolute and conditional convergence of series of real and complex terms, rearrangement of series. |
| Unit-2 | Continuity of functions of single variable, sequential continuity, Properties of continuous functions, Uniform continuity, chain rule of differentiability, Mean value theorems and their geometrical interpretations, Darboux's intermediate value theorem for derivatives. |
| Unit-3 | Limit and continuity of functions of two variables, Partial differentiation, Change of variables, Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobians. |
| Unit-4 | Envelopes, Evolutes, Maxima and Minima of functions of two variables, Lagrange's multiplier method, Beta and Gamma Functions. |
| Unit-5 | Double and triple integrals, volumes and surface of solids of revolution Dirichlet's integrals, changes of order of integration in double integrals. |

Text books:

1. R.R. Goldbeg -Real analysis, Oxford & I.B.H. publishing co., New Delhi.
2. Gorakh Prasad- Differential Calculus, Pothishala Pvt. Ltd. Allahabad.
3. Gorakh Prasad- Integral Calculus, Pothishala Pvt. Ltd. Allahabad.

Reference Books:


1. Gabriel Klaumber- Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
2. T.M. Apostol- Mathematical Analysis, Narosa Publishing house, New Delhi, 1985.
3. D. Soma Sundaram and B. Choudhary- A first Course in mathematical analysis, Narosa Publishing, House, New Delhi, 1997.
4. Murray R. Spiegel- Theory and problems of advance Calculus. Schauma Publishing Co., New York.
5. O. E. Stanaitis- An introduction to Sequences, Series and Improper Integrals.

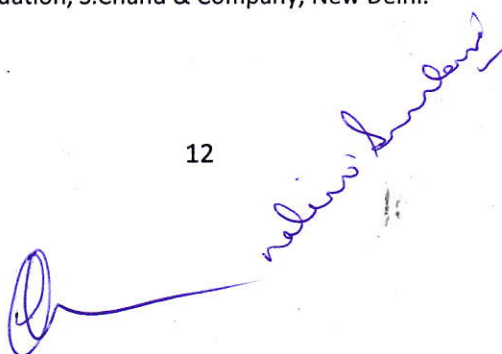
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|---------------|-----------------------------------|
| Class | B.Sc. II Year |
| Paper | Math- 202: Differential Equations |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

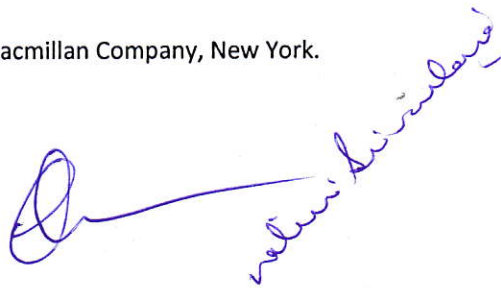
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|---------------|---|
| Unit-1 | Series solutions of differential equations, Power series method, Bessel and Legendre's equations, Bessel's and Legendre's functions and their properties- recurrence and generating function. Orthogonality of functions. |
| Unit-2 | Laplace Transformation, Linearity of the Laplace transformation, Existence theorem for Laplace transforms, Laplace transforms of derivatives and integrals, Shifting theorems, Differentiation and integration of transforms. |
| Unit-3 | Inverse Laplace transforms, Convolution theorem, Application of Laplace transformation for solving initial value problems of second order linear differential equations with constant coefficients. |
| Unit-4 | 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. |
| Unit-5 | Partial differential equations of second and higher orders, Classification of partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equation reducible to equations with constant coefficients, equation of vibrating string, heat equation, Laplace's equation and their solutions. |

Text Books:

1. Sharma and Gupta- Integral Transform, Pragati, Prakashan Meerut.
2. Sharma and Gupta- Differential Equation, Pragati, Prakashan Meerut.
3. Raisinghaniya- Differential Equation, S.Chand & Company, New Delhi.

Reference books:


1. D. A. Murray-Introductory course in differential equation, Orient Longman, India. 1967.
2. G. F. Simmons- Differential Equations, Tata Megraw Hill, 1972.
3. E. A. Condington- An Introduction to Ordinary differential equations. Prentice hall of India. 1961.
4. H.T.H. Piaggio- Elementary Treatise on Differential equations and their applications. C.B.S Publisher and Distributors, Delhi, 1985.
5. E.D Rainville- Special Functions, The Macmillan Company, New York.

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|---------------|---|
| Class | B.Sc. II Year |
| Paper | Math- 203: Vector Analysis and Geometry |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

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|------------|--|
| Unit - I | Product of four vectors, Reciprocal vectors, vector differentiation, Gradient, divergence and curl in cartesian and cylindrical coordinates. Higher order derivatives, vector identities and vector equations. |
| Unit - II | Vector Integration, Theorems of Gauss, Green, Stoke (without proof) and problems based on them. Application to geometry, curves in space, curvature and torsion, Serret-Frenet's formula. |
| Unit - III | General equation of second degree, tracing of conics, system of conics, polar equation of a conic. |
| Unit - IV | Equation of cone with given base, generators of cone, condition for three mutually perpendicular generators, Right circular cone, equation of cylinder and its properties. |
| Unit - V | Central conicoids, Paraboloid, Ellipsoid, hyperboloid of one and two sheets and their properties. |

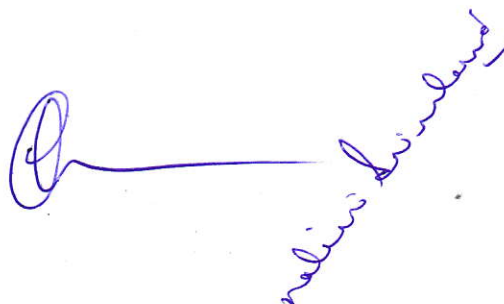
Suggested Books:

1. N. Saran and S.N. Nigam-Introduction to Vector Analysis, Pothishala Pvt. Ltd, Allahabad.
2. Gorakh Prasad and H.C. Gupta-Text Book on Coordinate Geometry, Pothishala Pvt. Ltd, Allahabad.
3. N. Saran and S.N. Nigam-Analytical Geometry of Three Dimensions, Pothishala Pvt. Ltd, Allahabad.
4. R.J.T. Bell-Elementary Treatise on Coordinate Geometry of Three Dimensions, McMillan India Ltd., 1994.
5. Murray R. Spiegel- Theory and Problems of Advance Calculus, Schaum Publishing Company, New York.
6. Murray R. Spiegel- Vector Analysis, Schaum Publishing Company, New York.
7. Shanti Narayan- A Text Book of Vector Calculus, S. Chand & Co., New Delhi.
8. Shanti Narayan- A Text Book of Vector Algebra, S. Chand & Co., New Delhi.
9. S.L. Loney-The Elements of Coordinate Geometry. Macmillan and Company, Lonon.
10. P.K. Jain and Khalil Ahmad- A Text Book of Analytical Geometry of Two Dimensions, Macmillan India Ltd., 1994.
11. P.K. Jain and Khalil Ahmad- A Text Book of Analytical Geometry of Three Dimensions, Macmillan India Ltd., 1999.

B.Sc-III Year (Pass Course)

Academic Session : 2019-2022

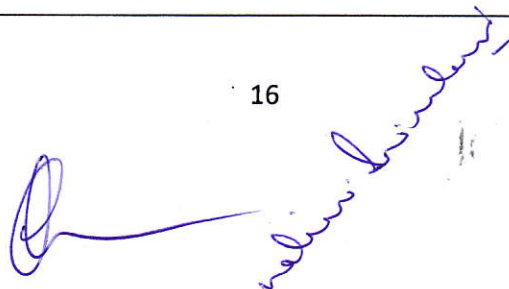
| Paper Number & Title of the Paper | Paper-wise Maximum Marks | Total Theory Marks | Internal Assesment Maximum Marks | Total |
|--|--------------------------|--------------------|----------------------------------|-------|
| Math301-Linear Algebra And Numerical Analysis | 40 | 120 | 10 | 150 |
| Math302-Real and Complex Analysis | 40 | | 10 | |
| Math 303-(Optional , Any One) 1.Discrete Mathematics 2.Statistical Methods | 40 | | 10 | |



| | |
|----------------------|---|
| Class | B.Sc. III Year |
| Paper | Math- 301: Linear Algebra and Numerical Analysis |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

Note:- Scientific Calculator will be allowed in the examination of this paper

| | |
|---------------|--|
| Unit-1 | Definition and examples of Vector spaces, subspaces, sum and direct sum of subspaces, Linear span, Linear dependence, independence and their basic properties, Basis, Existence Theorem for basis, Extension Theorem, Invariance of the number of elements of a basis, Dimension, Finite dimensional vector spaces, Existence of complementary subspaces of a subspace of a finite dimensional vector space, Dimension of sum of subspace, Quotient space and its dimension. |
| Unit-2 | Linear transformations and their representation as matrices, Algebra of linear transformations, Rank-Nullity theorem, change of basis, dual space, bi-dual space and natural isomorphism, adjoint of a linear transformation, eigen values and eigen vectors of a linear transformation, Diagonalisation, Bilinear, Quadratic and Hermitian forms. |
| Unit-3 | Inner Product Space- Cauchy-Schwartz inequality, orthogonal vectors, orthogonal complements, orthonormal sets and bases, Bessel's inequality for finite dimensional spaces, Gram-Schmidt orthogonalization process. |
| Unit-4 | Solution of Equations: Bisections, Secant, Regula Falsi, Newton's Methods. Roots of second degree polynomial equations. Interpolation: Lagrange interpolation, Divided differences, Interpolation formula using Differences. Numerical Quadrature. Newton-Cote's Formulae. Gauss Quadrature formulae |
| Unit-5 | Linear equations direct methods for solving systems of linear equations (Gauss elimination, LU decomposition, Cholesky decomposition), Iterative methods (Jacobi, Gauss-Seidel reduction methods). Ordinary differential equation: Euler's method, Single step method, Runge-Kutta's method, Multistep methods, Milne Simpson method. Methods based on Numerical integration, methods based on numerical differentiation. |

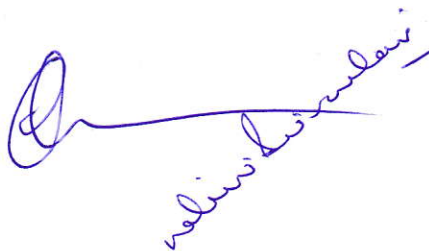


Text Books:

1. K.B Datta- Matrix and Linear Algebra, Prentice hall of India Pvt. Ltd NEW Delhi, 2000.
2. S.S Sastry- Introductory Methods of Numerical Analysis, PHI Learning Pvt. Ltd.

Reference Books:

1. K. Hoffman and R. Kunze- Linear Algebra, 2nd Edition, Prentice Hall Englewood Cliffs. New Jersey, 1971.
2. S.K. Jain, A. Gunawardena & P.B Bhattacharya- Basic Linear Algebra with MATLAB Key College Publishing (Springer- Verlag) 2001.
3. S. Kumarsaran- Linear Algebra. A Bermetric Approach Prentice-Hall of India, 200.
4. Balaguruswamy-Numerical Methods, Tata McGraw Hill Publication. New York.



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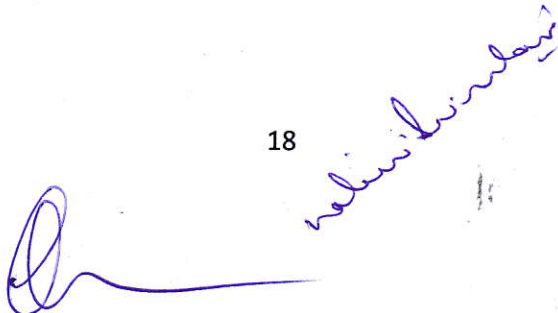
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|----------------------|---|
| Class | B.Sc. III Year |
| Paper | Math- 302: Real and Complex Analysis |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

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|---------------|--|
| Unit-1 | Riemann integral, Integrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus, Partial derivatives and differentiability of real-valued functions of two variables. Schwarz's and Young's theorem. Implicit function theorem. |
| Unit-2 | Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests. Frullani's integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter. Fourier series of half and full intervals. |
| Unit-3 | Definition and examples of metric spaces. Neighbourhoods. Limit points. Interior points. Open and closed sets. Closure and interior. Boundary points. Subspace of metric space, Cauchy sequence. Completeness, Cantor's intersection theorem. Contraction principle, Real number as a complete ordered field. Dense subsets. Baire Category theorem. Separable, second countable and first countable spaces, Continuous functions, Uniform continuity, Properties of continuous functions on compact sets. |
| Unit-4 | Continuity and differentiability of complex functions. Analytic functions. Cauchy-Reimann equations. Harmonic functions. Cauchy's Theorem, Cauchy's Integral formula. |
| Unit-5 | Power series representation of an analytical function, Taylor's series, Laurent's series, Singularities, Cauchy's Residual Theorem, Contour Integration. |

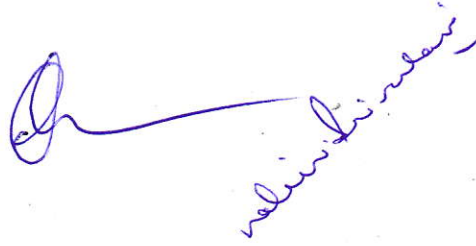
Text Books:

1. Mathematical analysis by S.C. Malik and Savita Arora, New Age Publication, Delhi.
2. G.F Simmons- Introduction to Topology and Modern Analysis. Mc Graw Hill, New York 1963.
3. L.V Ahlfors, Complex Analysis Mc Graw Hill, New York.

Reference Books:



1. Walter Rudin- Real and Complex Analysis, Mc Graw Hill, New York.
2. Ponnuswamy- Complex Analysis, Narosa Publication, New Delhi.
3. R.V. Churchill & J.W. Brown, Complex Variables and Application, 5th Edition , Mc Graw Hill, New York, 1990.

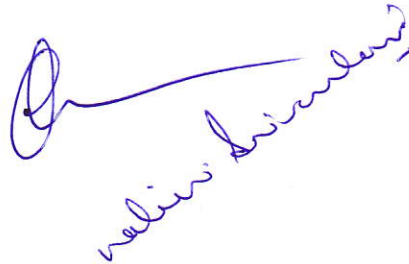
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|---------------|---|
| Class | B.Sc. III Year |
| Paper | Math- 303: Optional - Statistical Methods |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

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|------------|--|
| Unit - I | Frequency Distribution- Measures of Central Tendency, Mean, Median, Mode, G.M., H.M. Partition Values, Measures of dispersion- Range, Interquartile range, Mean deviation, Standard Deviation, Moments, Skewness and Kurtosis. |
| Unit – II | Probability- Event, Sample Space, Probability of an event, Addition and Multiplication Theorems, Baye's theorem, Continuous probability- Probability density function and its applications for finding the mean, median, mode and standard deviation of various continuous probability distributions. Mathematical expectations, Expectation of sum and product of random variables, Moment generating function. |
| Unit – III | Theoretical Distribution- Binomial, Poisson, rectangular and exponential distributions, their properties and uses. |
| Unit – IV | Methods of least square, Curve fitting, Correlation and regression, partial and multiple correlations (upto three variables only). |
| Unit – V | Sampling- Sampling of large samples, Null and alternative hypothesis, Errors and first and second kinds, Levels of significance, Critical region, Tests of significance based on chi-square, t, F and Z statistics. |

Suggested Books:

1. H.C. Saxena and J.N.Kapoor, Mathematical Statistics, S. Chand and Company.
2. M.Ray- Statistical Methods.
3. Books of Madhya Pradesh Hindi Granth Academy


Valis Bhandari

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|----------------------|---|
| Class | B.Sc. III Year |
| Paper | Math- 303: Optional - Discrete Mathematics |
| Type of Paper | Pass Course |
| Maximum Marks | 10 + 40 =50 |

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|-------------------|---|
| Unit - I | Boolean Functions- Disjunctive and conjunctive normal forms (canonical and dual canonical), Bool's expansion theorem, Relations- Binary relation, Inverse relation, Composite relation, Equivalence relation, Equivalence classes & its properties, Partition of a set. |
| Unit – II | Partial order relation, Partially ordered sets, totally ordered sets, Hasses diagram, maximal and minimal element, first and last element, Lattice- definition and examples, dual lattice, bonunded lattice, distributive lattice, complemented lattice. |
| Unit – III | Graph- Definition, types of graphs, Sub graphs, walk, path, circuit, connected and disconnected graphs. |
| Unit – IV | Euler graph, Hamiltonian path and circuit, shortest path in weighted graph, Dijkstra's Algorithm for shortest paths. |
| Unit – V | Mathematical modeling through graphs: Determination of solution of graph through modeling, guided graphs, mathematical modeling in relation to marked graphs and weighted graphs. |

Suggested Books:

1. J.N. Kapur- Mathematical Modeling, New Age International Publishers.
2. Books of Madhya Pradesh Hindi Granth Academy
3. Stefan Heinz- Mathematical Modeling, Springer.
4. Heilio M. Lahiovaara, T. Latinen- Mathematical Modeling, Springer Nature.
5. Dr V.P. Saxena- Bio-Mathematics
6. Belinda Barnes and Glenn Robert Fulford- Mathematical Modeling with case studies, CRC Press.

Belinda Barnes