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ST. ALOYSISUS' COLLEGE (AUTONOMOUS)
JABALPUR (M. P.), INDIA
Reaccredited 'A+' by NAAC with CGPA (3.68/4.0)
College with Potential for Excellence by UGC
DST-FIST supported
BACHELOR IN SCIENCE (B.Sc.)

Max.Marks	:	40
Class	:	BSc/B.A
Year	:	Third
Subject	:	Mathematics
Paper	:	I
Tittle	:	**Linear Algebra and Numerical analysis**

Course Objective:

Understand the numerical methods of their analysis for solving linear and non-linear system.

and to make the students see and understand the transition between abstract algebra of linear algebra and applications of linear algebra to real world.

Course Learning Outcomes:

Upon successful completion of this course, the students will be able to

CLO1 Identify and construct linear transformations of a matrix, their characterize attains. Evaluate linear systems represented as linear transforms, their representation as matrix equations, and vector equations.

COL2 Explain concepts of inner product on vector spaces.

CLO3 Understand the theoretical and practical aspects of the use of numerical analysis and its application.

CLO4 Establish the limitations, advantages, and disadvantages of numerical analysis. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration and the solution of linear equations nonlinear equations and differential equations.

CLO5 Use of numerical analysis and to obtain approximate solutions to otherwise intractable mathematical problems.

UNIT I : Definition and examples of Vector spaces, subspaces, sum and direct sum of subspaces, Linear span, Linear dependence, independence and their basic

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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 subspaces, Quotient space and its dimension.

UNIT II: 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 III: 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 IV: Solution of Equations: Bisection, Secant, Regula Falsi,Newton's Methods. Roots of second degree polynomial

Interpolation: Lagrange interpolation, Divided differences, Interpolation formula using Differences. Numerical Quadrature. Newton- Cote's formulae. Gauss Quadrature formulae.

UNIT V: 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 equations : Euler 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, Pretice 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. Hoffiman and R. Kunze- Linear Algebra, 2"d 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.Kumarasaran - Linear Algebra A Bermetric Approae Prentiee Hall of India, 2000
4. Balaguruswamy – Numerical Method Tata Mc. Grew Hil Publication.New York

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Max.Marks	:	40
Class	:	BSc/B.A
Year	:	Third
Subject	:	Mathematics
Paper	:	II
Title	:	**Real and Complex analysis**

Course Objective:

The Course aspires to make students understand the concepts of Real and Complex Analysis

Course Learning Outcomes:

Upon successful completion of this course, the student will be able to:

CLO1 Understand the concept of Riemann Integration and prove generalized results and solve partial differentiation of second order , total differentiation and problem based on Young and Swartz Theorem

CLO2 Evaluate Fourier series of half and full intervals.

CLO3 Comprehend open sets, closed sets, metric spaces, convergence and their properties.

CLO4 Appreciate the use of continuity and compactness in metric space.

CLO5 Apply the concept and consequences of analyticity and the Cauchy Residue Theorem.

UNIT I : Riemann integral, Integrability of continuous and monotonic function. The fundamental theorem of integral calculus. Mean value theorems of integral calculus, Partial

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derivatives and differentiability of real-Valued functions of two variables. Schwarz's and Young's theorem. Implicit function theorem.

UNIT II: 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 III: 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 sequences, 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 function on compact sets

UNIT IV: Continuity and differentiability of complex functions. Analytic functions. Cauchy-Reimann equations. Harmonic functions Cauchy's Theorem, Cauchy's integral formula

UNIT V: Power Series representation of an analytic function, Taylor's series, Laurant's series, Singularities, Cauchy's Residue 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. Alhfors, complex Analysis Mc. Graw Hill New York .

Recommend 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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BACHELOR IN SCIENCE (B.Sc.)

Max.Marks	:	40
Class	:	BSc/B.A
Year	:	Third
Subject	:	Mathematics
Paper	:	Third Optional - B
Title	:	**DISCRETE MATHEMATICS**

Course Objective:

Know how to apply the knowledge they have gained to solve real problems. And realize that there are multiple solutions to a given problem and these solutions will have a real impact on people's lives. and Know how to apply tools and ideas from mathematics and theoretical computer science to structure and solve complex problems.

Course Learning Outcomes:

On completion of syllabus student will be able to

CLO 1 Write and interpret mathematical notation and mathematical definitions. Appreciate the basic principles of Boolean algebra, Logic and Set theory.

CLO 2 Formulate and interpret statements presented in Boolean logic. Reformulate statements from common language to formal logic. Apply truth tables and the rules of propositional and predicate calculus.

CLO 3 Formulate short proofs using the following methods: direct proof, indirect proof, proof by contradiction and case analysis.

CLO 4 Demonstrate a working knowledge of set notation and elementary set theory, recognize the connection between set operations and logic, prove elementary results involving sets.

CLO 5 Model and solve real-world problems using graphs and trees, both quantitatively and qualitatively. Gain an historical perspective of the development of modern discrete mathematics.

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UNIT I: Boolean functions- disjunctive & conjunctive normal forms (canonical & 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, Hasse diagram, maximal and minimal element, first and last element, lattice- definition and examples, dual lattice, bounded lattice, distributive lattice, complemented lattice.

UNIT III : Graph- Definition, Types of Graphs, Subgraphs, Walk, path, circuit, connected and disconnected graph, Eular graph, Hamiltonian path and circuit, shortest path in weighted graph, Dijkstra's Algorithm for shortest paths.

UNIT IV : Trees and its properties, Rooted tree, Binary tree, Spanning tree, Rank and nullity of a graph, Kruskal's Algorithm and Prim's Algorithm.

UNIT V: Matrix representation of graphs- Incidence and Adjacency matrix, Cutset and its properties, Planar graphs (definition) Kuratowski's two graph.

TEXT BOOKS:

1. C.L.Liu.- Elements of Discrete Mathematics,Mcgraw Hill New-York
2. Narsingh Deo- Graph Theory, Prentice Hall.
3. Books of M.P. Hindi Granth Academy.

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Max.Marks	:	40
Class	:	BSc/B.A
Year	:	Third
Subject	:	Mathematics
Paper	:	Third Optional -A
Title	:	**Statistical Methods**

Course Objective:

The central objective is to equip students with consequently requisite quantitative and statistical skills that they can employ and build on in flexible ways. and students shall be able to design collected data, analyze data appropriately and interpret data and draw conclusions from those analyses.

Course Learning Outcomes:

Upon successful completion of this course, the student will be able to:

CLO1 Demonstrate the ability to apply fundamental concepts in exploratory data analysis.

CLO2 Appreciate the concepts of measure of dispersion and standard deviation of a statistics.

CLO3 Discuss the basic concepts of probability and random variables.

CLO4 Describe the main properties of probability distributions and random variables.

CLO5 Understand the concept of the sampling methods of a statistics.

CLO6 Comprehend the foundations for classical deduction involving estimation, hypothesis testing, regression and correlation analysis.

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Unit 1: Frequency distribution- Measure 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 2: Probability- Event, Sample space, Probability of an event. Addition and Multiplication theorems. Baye's theorem, Continuous Probability-Probability density function and its application for finding the mean ,mode median and standard deviation of various continuous probability distributions. Mathematical expectation. Expectation of sum and product of random variables. Moment generating function.

Unit 3: Theoretical Distribution-Binomial, Possion, rectangular and exponential distributions their properties and uses.

Unit 4: Method of least squares. Curve Fitting, co-relation and regression partial and multiple correlation (upto three variable only).

Unit 5: Sampling – Sampling of large sample. Null and alternative hypothesis, Errors of first and second kinds. Level of significance. Critical region. Fest of significance based on chi-square-t, F, Z-statistics

Text Books:

1. H.C. Saxena and J.N. Kapoor, Mathematical statistics, S. Chand and Compony
2. M. Ray- Statistical Methods.
3. Books of M.P. Hindi Granth Academy.

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