Lesson Plan for the session 2023-24

Paper: **Business Mathematics**

Class: **B.Com Semester 1st**

Teacher name: **Saroj Bala**

July

Discussion about the basic concepts of the previous class. Set Theory: Representation of sets, equivalent sets, power set, complement of a set.

August

Venn Diagrams: Union and intersection of sets, De-Morgan's laws; Logical statements and truth tables.

September

Logarithms: Laws of operation, log tables; Arithmetic and geometric progression.

October

Matrices and Determinants: Definition of a matrix, order, equality, types of matrices; Operations on matrices: Addition, multiplication and multiplication with a scalar and their simple properties. Determinant of a square matrix (upto 3 x 3 order): Properties of determinants, minors, co-factors and applications of determinants in finding the area of triangle, adjoint and inverse of a square matrix, solutions of a system of linear equations by examples.

November

Compound interest and annuities: Different types of interest rates, types of annuities, present value and amount of an annuity (including the case of continuous compounding), valuation of simple loans and debentures, problems related to sinking funds.

Lesson Plan for the session 2023-24

Paper: Business Mathematics

Class: B.Com Semester 2nd

Teacher name: Saroj Bala

January

Differentiation; derivative of simple functions and other functions (excluding trigonometric functions) having applications in business studies; Maxima and minima of Revenue, Cost, Demand, Production, Profit functions and other functions related to business and commerce.

February

Integration: Definite and indefinite (simple functions excluding trigonometric functions), basic rules of integration, application of integration in commercial and business problems.

March

Binomial Theorem; Permutations and Combinations.

April

Linear Programming: Formulation of linear programming problems (LPP) and their solution by graphical and simplex methods, Applications of linear programming in solving problems related to business and commerce.

Revision and Class Test.

Lesson Plan for the session 2023-24

Subject : Mathematics

Paper: Calculus

Class: B.A/B.Sc Semester 1st

Teacher name: Saroj Bala

July

Discussion about the basic concepts of the previous class.
Definition of limit and continuity of a real valued function, Basic properties of limits.
Practicals.

August

Types of discontinuities, Differentiability of functions, Application of L'Hospital rule to indeterminate forms, Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's series expansion with different forms of remainder.
Practicals.

September

Asymptotes: Horizontal, vertical and oblique asymptotes for algebraic curves, Asymptotes for polar curves, Intersection of a curve and its asymptotes, Curvature and radius of curvature of curves (Cartesian, parametric, polar & intrinsic forms), Newton's method, Centre of curvature and circle of curvature.
Practicals.

October

Multiple points, Node, Cusp, Conjugate point, Tests for concavity and convexity, Points of inflexion, tracing of curves, Reduction formulae.
Practicals.

November

Rectification, intrinsic equation of a curve, Quadrature, Area bounded by closed curves, Volumes and surfaces of solids of revolution.
Practicals.
Revision and Class Test

Lesson Plan for the session 2023-24

Paper: Algebra and Number Theory

Class: B.A/B.Sc Semester 2nd

Teacher name: Saroj Bala

January

Symmetric, Skew symmetric, Hermitian and skew Hermitian matrices, Elementary operations on matrices, Rank of a matrix, Inverse of a matrix, Linear dependence and independence of rows and columns of matrix, Row rank and column rank of a matrix, Eigen values, Eigen vectors and characteristic equation of a matrix, Minimal polynomial of a matrix, Cayley-Hamilton theorem and its use in finding the inverse of a matrix, Unitary and orthogonal matrices.
Practicals

February

Relations between the roots and coefficients of general polynomial equation in one variable, Solutions of polynomial equations having conditions on roots, Common roots and multiple roots, Transformation of equations, Nature of the roots of an equation, Descarte's rule of signs.
Practicals

March

Solutions of cubic equations (Cardon's method), Biquadratic equations and their solutions. Divisibility, Greatest common divisor (gcd), Least common multiple (lcm), Prime numbers, Fundamental theorem of arithmetic.
Practicals

April

Linear congruences, Fermat's theorem, Euler's theorem, Wilson's theorem and its converse, Chinese Remainder theorem, Linear Diophantine equations in two variables.

Revision and Class Test

Lesson Plan for the session 2023-24

Subject : Mathematics

Paper 1: Advanced Calculus

Class: B.A/B.Sc   Semester 3rd

Teacher name: Kavita

July

Discussion about the basic concepts of the previous class. Continuity, Sequential continuity, properties of continuous functions, Uniform continuity, Chain rule of differentiability.

August

Mean value theorems; Rolle's theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's theorem with various form of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

September

Limit and continuity of real valued functions of two variables. Partial differentiation. Total differentials; Composite functions and implicit functions. Change of variables. Homogeneous functions and Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

October

Differentiability of real valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

November

Curves: Tangents, Principal normals, Binormals, Serret-Frenet formulae. Locus of the centre of curvature, Spherical curvature, Locus of centre of spherical curvature, Involutes, Evolutes, Bertrand curves. Surfaces: Tangent planes, one parameter family of surfaces, Envelopes.

Revision and Class Tests.

Lesson Plan for the session 2023-24

Subject : Mathematics

Class: B.A./B.Sc. Semester 3rd

Teacher name: Saroj Bala

Paper 2 : Partial Differential Equations

July

Discussion about the basic concepts of the previous classes.
Partial differential equations: Formation, order and degree.

August

Linear and Non-Linear Partial differential equations of the first order
Complete solution, singular solution, General solution, Solution of Lagrange's linear
equations, Charpit's general method of solution. Compatible systems of first order
equations, Jacobi's method.

September

Linear partial differential equations of second and higher orders. Linear
and non-linear homogenious and non-homogenious equations with constant co-
efficients, Partial differential eqution with variable co-efficients reducible to
equations with constant coefficients, their complimentary functions and particular
Integrals, Equations reducible to linear equations with constant co-efficients.

October

Classification of linear partial differential equations of second order.
Hyperbolic, parabolic and elliptic types, Reduction of second order linear partial
differential equations to Canonical (Normal) forms and their solutions. Solution of
linear hyperbolic equations, Monge's method for partial differential equations of
second order.

November

Cauchy's problem for second order partial differential equations.
Characteristics equation's and characteristics curves of second order partial
differential equation, Method of separation of variables: Solution of Laplace's
equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one
and two dimension) in Cartesian Co- ordinate system. Revision and Class tests.

Lesson Plan for the session 2023-24

Subject : Mathematics

Class: B.A./B.Sc. Semester 3rd

Teacher name: Kavita

Paper 3: Statics

July

Basic Concepts of the previous class.
Composition and resolution of forces.

August

Composition and resolution of forces. Parallel forces. Moments and Couples.

September

Analytical conditions of equilibrium of coplanar forces. Friction. Centre of
Gravity.

October

Virtual work. Forces in three dimensions. Poinsots central axis.

November

Wrenches. Null lines and planes. Stable and Unstable Equilibrium. Revision and
Class

Lesson Plan for the session 2023-24

Subject : Mathematics

Class: B.A./B.Sc. Semester 4th

Teacher name: Kavita

Paper 1: Sequence and Series

January

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano- Weiestrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

February

Sequence: Real Sequences and their convergence. Theorem on limits of sequence, Bounded and monotonic sequences. Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Subsequential limits. Infinite series. Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series.

March

Infinite series: D-Alembert's ratio test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Cauchy's Nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test.

April

Alternating series, Leibnitz's test, absolute and conditional convergence. Arbitrary series: abel's lemma, Abel's test, Dirichlet's test. Insertion and removal of parenthesis, re- arrangement of terms in a series. Dirichlet's theorem, Riemann's Re-arrangement theorem, Pringsheim's theorem (statement only), Multiplication of series, Cauchy product of series, (definitions and examples only)Convergence and absolute convergence of infinite products.

Revision and Class Tests.

Lesson Plan for the session 2023-24

Subject : Mathematics

Class: B.A./ B.Sc. Semester 4th

Teacher name: Saroj Bala

Paper 2: Special Functions and Integral Transforms

January

Series solution of differential equations – Power series method. Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties- Convergence, recurrence, Relations and generating functions. Orthogonality of Bessel functions.

February

Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orhogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials. Laplace Integral Representation of Legendre polynomial.

March
Laplace Transforms – Existence theorem for Laplace transforms. Linearity of the Laplace transforms, Shifting theorems. Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using.

April

Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms. Revision and Test.

Lesson Plan for the session 2023-24

Subject : Mathematics

Class B.A./B.Sc. Semester 4th

Teacher name: Kavita

Paper 3: Programming in C and Numerical Methods

January

Programmer's model of a computer, Algorithms, Flow charts. Data types, Operators and expressions, Input / outputs functions. Practicals

February

Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Preprocessors and Arrays. Practicals

March

Strings: Character Data Type, Standard String handling Functions. Arithmetic Operations on Characters. Structures: Definition, using Structures, use of Structures in Arrays and Arrays in Structures. Pointers: Pointers Data type, Pointers and Arrays, Pointers and Functions.

Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton Raphson's method. Newton's iterative method for finding pth root of a number, Order of convergence of above methods. Practicals

April

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method. Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method. Revision and Class Tests.

Lesson Plan for the session 2023-24

Subject : Mathematics

Class B.A./B.Sc. Semester 5th

Teacher name: Kavita

Paper 1: Real Analysis

July

Basic concepts of the previous class.
Riemann integral.

August

Integrabililty of continuous and monotonic functions, The Fundamental theorem of integral calculus. Mean value theorems of integral calculus.

September

Improper integrals and their convergence. Comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter Continuity, Differentiability and integrability of an integral of a function of a parameter.

October

Definition and examples of metric spaces, neighborhoods, limit points, interior points, open and closed sets, closure and interior, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness, Cantor's intersection theorem, Baire's category theorem, contraction Principle.

November

Continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass property, total boundedness, finite intersection property, Continuity in relation with compactness, connectedness, components, continuity in relation with connectedness. Revision and Class Tests.

Lesson Plan for the session 2023-24

Subject : Mathematics

Class: B.A./B.Sc. Semester 5th

Teacher name: Kavita

Paper 2: Groups and Rings

July

Discussion about the basic concepts of the previous class.

Definition of a group with example and simple properties of groups.

August

Subgroups and Subgroup criteria, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Largrage's theorem and its consequences, Normal subgroups, Quotient groups.

September

Homoomorphisms, isomophisms, automorphisms and inner automorphisms of a group. Automorphisms of cyclic groups, Permutations groups. Even and odd per mutations. Alternating groups, Cayley's theorem, Center of a group and derived group of a group.

October

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphisms, ideals (principle, prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

November

Euclidean rings, Polynomial rings. Polynomials over the rational field, The Eisenstein's criterion, Euclidean rings. Polynomial rings. Polynomials over he rational field. The Eisenstein's criterion. Revision and Class Tests.

Lesson Plan for the session 23-24

Subject : Mathematics

Class: B.A./B.Sc. Semester 5th

Teacher name: Saroj Bala

Paper 3: Numerical Analysis

July

Basic concepts of the previous class.
Finite Differences operators and their relations.

August

Finding the missing terms and effect of error in a difference tabular values.
Interpolation with equal intervals: Newton's forward and Newton's backward
interpolation formulae. Interpolation with unequal intervals: Newton's divided difference.
Lagrange's Interpolation formulae, Hermite Formula. Practicals

September

Central Differences: Gauss forward and Gauss's backward interpolation formulae.
Sterling, Bessel Formula. Probability distribution of random variables. Binomial
distribution, Poisson's distribution, Normal distribution: Mean, Variance and Fitting.
Practicals

October

Numerical Differentiation: Derivative of a function using interpolation formulae
as studied in Sections –I & II.

Eigen Value Problems: Power method, Jacobi's method, Given's method, House-
Holder's method, QR method, Lanczos method. Practicals

November

Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule.
Simpson's one- third and three-eighth rule, Chebychev formula, Gauss Quadrature
formula.

Numerical solution of ordinary differential equations: Single step methods-
Picard's method. Taylor's series method, Euler's method, Runge-Kutta Methods.
Multiple step methods; Predictor-corrector method, Modified Euler's method, Milne-
Simpson's method.

Revision and Class Tests.

Lesson Plan for the session 2023-24

Subject : Mathematics

Class: B.A./B.Sc. Semester 6th

Teacher name: Saroj Bala

Paper 1: Real and Complex Analysis

January

> Jacobians, Beta and Gama functions, Double and Triple integrals, Dirichlets integrals, change of order of integration in double integrals.

February

> Fourier's series: Fourier expansion of piecewise monotonic functions. Properties of Fourier Co-efficients, Dirichlet's conditions, Parseval's identity for Fourier series, Fourier series for even and odd functions. Half range series, Change of Intervals.

March

> Extended Complex Plane, Stereographic projection of complex numbers, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations. Harmonic functions.

April

> Mappings by elementary functions: Translation, rotation, Magnification and Inversion. Conformal Mappings, Mobius transformations. Fixed points, Cross ratio, Inverse Points and critical mappings. Revision and Class Tests.

Lesson Plan for the session 2023-24

Subject : Mathematics

Class: B.A./B.Sc. Semester 6th

Teacher name: Kavita

Paper 2: Linear Algebra

January

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space, Finitely generated vector space, Existence theorem for basis of a finitely generated vactor space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

February

Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vactor spaces, Vactor space of all the linear transformations, Dual Spaces, Bidual spaces, annihilator of subspaces of finite dimentional vactor spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem.

March

Algebra of Liner Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.

April

Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt, Orthogonalization process, Adjoint of a linear transformation and its properties, Unitary linear transformations, Revision and Class Tests.

Lesson Plan for the session 2023-24

Subject : Mathematics

Class: B.A /B.Sc. Semester 6th

Teacher name: Kavita

Paper 3: Dynamics

January

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings.

February

Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy. Definitions of Conservative forces and Impulsive forces.

March

Motion on smooth and rough plane curves. Projectile motion of a particle in a plane. Vector angular velocity.

April

General motion of a rigid body. Central Orbits, Kepler laws of motion. Motion of a particle in three dimensions. Acceleration in terms of different co-ordinate systems. Revision and Class Tests.