

Institute for Excellence in Higher Education (IEHE), Bhopal

S-161 (N-18)

B.Sc.(HONOURS): PART-I

Semester: I

SUBJECT: MATHEMATICS

PAPER: HONOURS-I

Session 2020-2021

TITLE: DISCRETE MATHEMATICS

SYLLABUS

Logics and Propositional Calculus:

Propositions, Compound propositions, Basic logical operations, Truth tables, Tautologies and Contradictions, Logical equivalence, Algebra of Propositions, Conditional and Biconditional Statements.

Relations:

Binary relation, Equivalence relations, Partitions, Partial Ordered Relations, Pigeon-Hole Principle. Ordered sets and Lattices, Hasse diagrams of partially ordered sets, supremum and infimum, well ordered sets, lattices, Bounded lattices, Distributive and Complemented Lattices.

Boolean Algebra:

Boolean Algebra and its properties, Demorgan's law, Algebra of Electric circuits and its applications. Boolean Function, Disjunction and Conjunction Normal Forms, Boole's Expansion Theorem. Logic gates

Graphs :

Graph, finite and infinite graphs, incidence and degree, isolated vertex, pendent vertex and Null graph. Isomorphism, subgraphs, walks, paths and circuits, connected graphs, disconnected graphs, components, Euler graphs, operations on graphs, more on Euler graphs, Hamiltonian paths & circuit.

Trees:

Some properties of trees, Distance and Centres in a tree, Rooted & Binary trees, Spanning trees, Fundamental Circuits.

Recommended Books:

1. Narsingh Deo, Graph Theory, PHI
2. Seymour Lipschutz and Mark Lipson, Discrete Mathematics (Schaums Outline), Tata McGraw Hill
3. C.L. Liu, Elements of Discrete Mathematics, Tata McGraw Hill

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Institute for Excellence in Higher Education (IEHE), Bhopal

S-162 (A) (R-18)

B.Sc.(HONOURS): PART-I

Semester: I

SUBJECT: MATHEMATICS

PAPER: HONOURS-II/SUBSIDIARY (A)

Session 2020-2021

TITLE: CALCULUS

SYLLABUS

Differential Calculus:

Successive differentiation. Convergence of series, Expansion of functions (Leibnitz theorem. Maclaurin and Taylor series expansions). Tangent and Normals, Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates.

Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points..Tracing of curves in Cartesian, parametric and polar co-ordinates.

Integral Calculus:

Area of curves, Length of the curve, Volumes and surfaces of solids of revolutions, Multiple integrals (Double and Triple integrals, Dirichlets integrals, Change of order of integration in double integrals), Beta and Gamma functions , Applications of integration(Centre of Gravity, Centre of Pressure, Moment of inertia).

Recommended Book:

1. Gorakh Prasad, Differential Calculus, Pothishasla Pvt. Ltd., Allahabad.
2. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad.

Reference Books:

- R.G.Bartle and D.R.Sherbert, Introduction to Real Analysis, John Wiley & Sons(2003).
- S C Malik and Savita Arora ;Mathematical analysis, New Age International(P) Limited, Publishers, New Delhi, Fifth edition, 2017
- Shanti Narayan, Differential and Integral Calculus, S. Chand & Company, Osmania University.
- Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaun's Outline Series, Schaum Publishing Co., New York.
- N. Piskunov, Differential and integral Calculus, Peace Publishers, Moscow.
- Gabriel Klambauer, Mathematical Analysis Marcel Dekkar, Inc. New York, 1975.



Institute for Excellence in Higher Education (IEHE), Bhopal

S-162 (B) (N-08)

B.Sc.(HONOURS): PART-I

Semester: I

SUBJECT: MATHEMATICS

PAPER: HONOURS-II/SUBSIDIARY (B)

Session 2020-2021

TITLE: ALGEBRA & TRIGONOMETRY

SYLLABUS

Algebra:

Matrices: Symmetric, Skew symmetric, Hermitian and skew-Hermitian matrices. Elementary Operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigen values, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix. **Applications of matrices to a system of linear** (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, positive definite matrices, Quadratic forms.

Theory of Equations: 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. **Symmetric functions of roots, Solutions of cubic equations** (Cardon's method).

Trigonometry:

De Moivre's theorem and it's applications, Direct and Inverse Circular and Hyperbolic functions. Logarithm of complex quantities. Gregory's series

Books Recommended:

1. H. S. Hall and S.R. Knight, Higher Algebra, H.M. Publications 1994.
2. Shanti Narayan , A Text Books of Matrices, S. Chand Publications.
3. Chandrika Prasad, Text Book on Algebra and Theory of Equations, Pothishala Private Ltd., Allahabad.
4. S. L. Loney, Plane Trigonometry Part – II, Macmillan and Company, London.
5. R. S. Verma and K.S. Shukla, Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.

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Institute for Excellence in Higher Education (IEHE), Bhopal

S-261 (N-18)

B.Sc.(HONOURS) : PART-I

Semester: II

SUBJECT: MATHEMATICS

PAPER: HONOURS-I

Session 2020-2021

TITLE: Introduction to MATLAB

SYLLABUS

MATLAB - Overview: MATLAB's Power of Computational Mathematics, Features of MATLAB, Uses of MATLAB. Understanding the MATLAB Environment. MATLAB - Basic Syntax: Use of Semicolon (;) in MATLAB, Adding Comments, Commonly used Operators and Special Characters, Special Variables and Constants, Naming Variables, Saving Your Work. MATLAB - Variables: Multiple Assignments, Long Assignments, The format Command, Creating Vectors, Creating Matrices.

MATLAB - Commands: Commands for Managing a Session, Commands for Working with the System, Input and Output Commands, Vector, Matrix and Array Commands, Plotting Commands. MATLAB - M-Files: The M Files, Creating and Running Script File, MATLAB - Data Types: Data Types Available in MATLAB, Data Type Conversion, Determination of Data Types. MATLAB - Operators: Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operations, Set Operations.

MATLAB - Decision Making. MATLAB - Loop Types: Loop Control Statements. MATLAB - Vectors: Row Vectors, Column Vectors, Referencing the Elements of a Vector, Vector Operations. MATLAB - Matrix: Referencing the Elements of a Matrix, Deleting a Row or a Column in a Matrix, Matrix Operations. MATLAB - Arrays: Special Arrays in MATLAB, A Magic Square, Multidimensional Arrays, Array Functions, Sorting Arrays, Cell Array, Accessing Data in Cell Arrays.

MATLAB - Colon Notation. MATLAB - Numbers: Conversion to Various Numeric Data Types, Smallest and Largest Integers, Smallest and Largest Floating Point Numbers. MATLAB - Strings: Rectangular Character Array, Combining Strings into a Cell Array, String Functions in MATLAB. MATLAB - Functions: The eval function, Inline functions, Anonymous Functions, Primary and Sub-Functions, Nested Functions, Private Functions, Global Variables.

Books Recommended:

1. Rudra Pratap, Getting Started With MATLAB, Oxford University Press, Indian Edition
2. Brian R. Hunt, A Guide to MATLAB, Cambridge University Press
3. Amos Gilat, MATLAB-An Introduction with applications, The Ohio State University
4. Dr. Shailendra Jain, Modeling and Simulation Using MATLAB- SIMULINK

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Institute for Excellence in Higher Education (IEHE), Bhopal

S-261 (N-18)

B.Sc.(HONOURS): PART-I

Semester: II

SUBJECT: MATHEMATICS

PAPER: HONOURS-I

Session 2020-2021

TITLE: Introduction to MATLAB

List of Practical's in MATLAB

1. Using basic command for arithmetic operation, exponential and logarithmic operations.
2. Creating M-file.
3. Creating own directory in MATLAB.
4. Creating exponentially decaying sine plot.
5. Create 3x3 matrices with zeros and ones. Create a 3x3 identity matrix.
6. Add columns and rows to matrix and setting it to equal to different columns and rows of matrix.
7. Create a random matrix and find its transpose.
8. Perform matrix and array exponentiation, finding the determinant and inverse of a matrix.
9. Writing a script file in MATLAB.
10. Create a function file to compute the factorial n, for any integer n using "for" loop

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Institute for Excellence in Higher Education (IEHE), Bhopal

S-262 (A) (N-16)

B.Sc.(HONOURS) : PART-I

Semester: II

SUBJECT: MATHEMATICS

PAPER: HONOURS-II/SUBSIDIARY(A)

Session 2020-2021

TITLE: ORDINARY DIFFERENTIAL EQUATION

SYLLABUS

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. First order higher degree equations solvable for x, y, p Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form.

Singular solutions. Orthogonal trajectories in Cartesian coordinates and polar coordinates. Self orthogonal family of curves.

Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous linear ordinary differential equations.

Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation.

Method of variations of parameters. Method of undetermined coefficients. Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators x (d/dx) or t (d/dt) etc. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. Total differential equations.

Condition for $Pdx + Qdy + Rdz = 0$ to be exact. General method of solving $Pdx + Qdy + Rdz = 0$ by taking one variable constant. Method of auxiliary equations.

Books Recommended:

1. D.A. Murray, Introductory Course in Differential Equations. Orient Longman (India). 1967
2. A. R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd. London.
3. E. A. Codrington, Introduction to Differential Equations.
4. S. L. Ross, Differential Equations, John Wiley & Sons.
5. B. Rai & D.P. Chaudhary, Ordinary Differential Equations; Narosa, Publishing House Pvt. Ltd.
6. H.T.H. Piaggio, Elementary Treatise on Differential Equations, PHI, 1961.

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Institute for Excellence in Higher Education (IEHE), Bhopal

S-262 (B) (N-09)

B.Sc.(HONOURS) : PART-I

Semester: II

SUBJECT: MATHEMATICS PAPER: HONOURS-II/SUBSIDIARY (B)

Session 2020-2021

TITLE: GEOMETRY AND VECTOR CALCULUS

SYLLABUS

GEOMETRY:

General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic. Polar equation of a conic, tangent and normal to the conic.

Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres.

Cones. Right circular cone, enveloping cone and reciprocal cone.

Cylinder: Right circular cylinder and enveloping cylinder.

VECTOR CALCULUS:

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors.

Vector differentiation. Scalar valued point functions, vector valued point functions, derivative along a curve, directional derivatives.

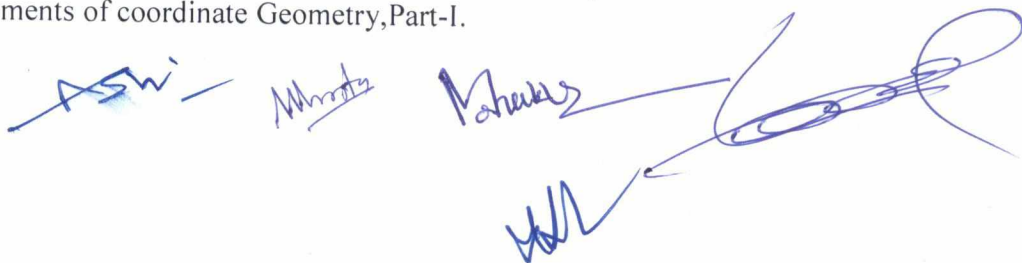
Gradient of a scalar point function, geometrical interpretation of $\text{grad } \Phi$, character of gradient as a point function. Divergence and curl of vector point function, Characters of Divergence and Curl as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities.

Laplacian operator. Vector integration; Line integral, Surface integral, Volume integral.

Books Recommended:

1. R.J.T. Bell, Elementary Treatise on Coördinary Geometry of Three Dimensions, MacMillan India Ltd. 1994.
2. P.K. Jain and Khalil Ahmad, A Textbook of Analytical Geometry of Two Dimensions, Wiley Eastern Ltd. 1999.
3. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
4. Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
5. N. Saran and S.N. Nigam, Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
6. Shanti Narayna, A Text Book of Vector Calculus. S. Chand & Co., New Delhi.
7. S.L. Loney, The elements of coordinate Geometry, Part-I.

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B.Sc.(HONOURS): PART-II

Semester: III

SUBJECT: MATHEMATICS

PAPER: HONOURS-I

Session 2020-2021

TITLE: MATLAB ADVANCED

MATLAB - Algebra: Solving Basic Algebraic Equations in MATLAB, Solving Quadratic Equations in MATLAB, Solving Higher Order Equations in MATLAB, Solving System of Equations in MATLAB, Solving Ordinary Differential Equations. Interpolation. MATLAB - Polynomials: Evaluating Polynomials, Finding the Roots of Polynomials, Polynomial Curve Fitting (Linear, Quadratic and Cubic), Curve fitting with polynomial functions, Least squares curve fitting.

Data Analysis and Statistics (mean, median, and standard deviation). Finding the determinant of a matrix, Finding eigenvalues and eigenvectors. Numerical Integration, Double integration, **MATLAB - Transforms:** The Laplace Transform, The Inverse Laplace Transform, The Fourier Transforms, Inverse Fourier Transforms.

MATLAB - Plotting: Adding Title, Labels, Grid Lines and Scaling on the Graph, Drawing Multiple Functions on the Same Graph, Setting Colors on Graph, Setting Axis Scales, Generating Sub-Plots, Basic 2-D Plots, Style options, Labels, title, legend, and other text objects, Axis control, zoom in, and zoom out, Overlay plots, Specialized 2-D plots.

MATLAB - Graphics: Drawing Bar Charts, Drawing Contours, Three Dimensional Plots, 3-D Plots: View, Rotate view, Mesh and surface plots. **MATLAB - Simulink:** Using Simulink, Building Models

Text Books:

1. Rudra Pratap, Getting Started with MATLAB, Oxford University Press.
2. Amos Gilat, MATLAB-An Introduction with Applications.
3. Brian R.Hunt, A Guide to MATLAB, Cambridge University Press.
4. Rao V. Dukkipati, MATLAB An Introduction with Applications, New Age International (P) Limited, Publishers.

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B.Sc.(HONOURS) : PART-II

Semester: III

SUBJECT: MATHEMATICS

PAPER: HONOURS-I

Session 2020-2021

TITLE: MATLAB ADVANCED

List of Recommended Practical's

1. Use built-in basic fitting to do a linear fit.
2. Use built-in basic fitting to do a quadratic and cubic fit.
3. Do exponentially curve fit in linear scale plot and semi-log scale plot.
4. Use different methods of interpolation i.e. nearest, cubic, linear, spline to do 1-D and 2-D interpolation.
5. Using built-in ODE solvers to solve first order ODE.
6. Using built-in ODE solvers to solve second order ODE.
7. Use built-in function to solve transcendental equation.
8. Use built-in function to find all the roots of a polynomial equation.
9. Use of different graphic tools in 2-D and 3-D plots.
10. Use of built-in function to generate overlay plots.

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SYLLABUS

Limits: ϵ - δ definition of the limit of a function, Left hand and right hand limits, Theorems on limits, Sequential approach of limit, Cauchy's criterion for finite limit. **Continuous functions:** Continuity at a point, Continuity in an interval, discontinuous functions, theorems on Continuity, Continuous functions on closed intervals, uniform continuity.

Derivatives: Derivability at a point, Derivability in an interval, Derivability and continuity. Increasing and decreasing functions, Sign of derivatives, Darboux's theorem, Rolle's theorem, Interpretation of Rolle's theorem, Lagrange's mean value theorem, deductions and geometrical interpretation of it, Cauchy's mean value theorem.

Higher order derivatives: Taylor's theorem (Remainder form), Maclaurin's theorem (Remainder form), Generalized mean value theorem, Taylor's infinite series and power series expansions, Maclaurin's infinite series. **Maxima, Minima and Indeterminate forms:** Extreme values, Investigation of the points of maximum and minimum values, Indeterminate forms $0/0$, ∞/∞ , $0 \times \infty$, $\infty - \infty$, 0^0 , 1^∞ , and ∞^0 .

Functions of several variables: Explicit and implicit functions, Explicit function of two variables, Neighbourhood of a point, Limit point, Limit of a function, Algebra of limits, Repeated limits, Continuity of function of two variables, Partial derivatives, Mean value theorem, Differentiability, Algebra of differentiable functions, Partial derivatives of higher order, Change in the order of partial derivation, Young's theorem, Schwarz's theorem, Differentials of higher order, Function of functions, Differentials of higher order of a function of functions, Derivation of composite functions (The chain rule), Change of variables, Taylor's theorem for two variables, **Extreme values (Maxima and minima) of function of two variables**, Function of several variables, **Extreme values (Maxima and minima) of function of n variables**.

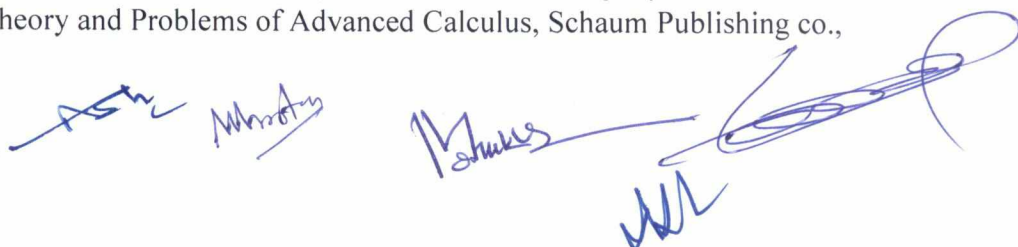
Implicit Functions: Existence theorem for two variables, Existence theorem for n variables, derivatives of Implicit Functions, Jacobians, Stationary values under subsidiary conditions, Lagrange's undetermined multipliers, Lagrange's method of multipliers.

Recommended Book:

1. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, John Wiley & Sons (2003).
2. S C Malik and Savita Arora; Mathematical analysis, New Age International (P) Limited, Publishers, New Delhi, Fifth edition 2017.

Reference Books:

- R. R. Goldberg, Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
- Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad. 1997
- Shanti Narayan, A Course in Mathematical Analysis, S. Chand and company, New Delhi
- Murray, R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing co., New York



B.Sc.(HONOURS): PART-II

Semester: III

SUBJECT: MATHEMATICS

PAPER: HONOURS-II/SUBSIDIARY(B)

Session 2020-2021

TITLE: Numerical Methods

SYLLABUS

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

Interpolation: Finite Differences operators and their relations. 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.

Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula.

Numerical Differentiation: Derivative of a function using interpolation formulae as studied in the above parts.

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

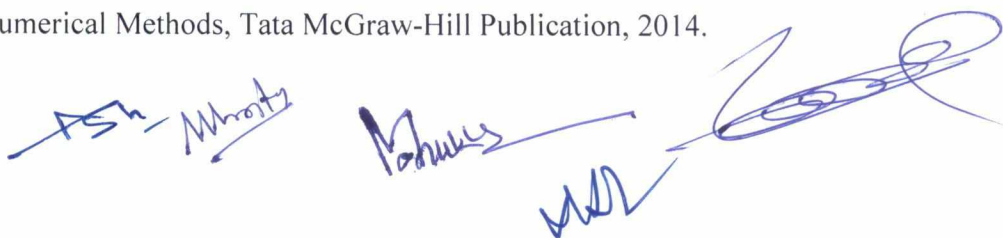
Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

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.

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

Books Recommended:

1. Babu Ram, Numerical Methods, Pearson Publication.
2. R. S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.
3. M. K. Jain, S. R. K. Iyengar, R.K. Jain, Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
4. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999.
5. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition).
6. Melvin J. Maaron, Numerical Analysis-A Practical Approach, Macmillan Publishing Co., Inc., New York.
7. E. Balagurusamy: Numerical Methods, Tata McGraw-Hill Publication, 2014.



B.Sc.(HONOURS) : PART-II

Semester: IV

SUBJECT: MATHEMATICS

PAPER: HONOURS-I

Session 2020-2021

TITLE: INTEGRAL TRANSFORM

SYLLABUS

Laplace Transforms:

Existence theorem for Laplace transforms, Linearity property of the Laplace transforms, Existence of Laplace transforms, Shifting theorems, Change of scale property, Laplace transforms of derivatives, Laplace transforms of integrals, Multiplication and division by 't', Periodic function.

Inverse Laplace transforms:

Linearity property, Shifting theorems, Change of scale property, Inverse Laplace transforms of derivatives, Inverse Laplace transforms of integrals, Multiplication and division by powers of p, convolution theorem, Heaviside expansion theorem.

Application of Laplace transform:

Solution of ordinary differential equations with constant coefficients, Solution of ordinary differential equations with variable coefficients.

Fourier transforms:

Linearity property, Shifting, Change of scale property, 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.

Books Recommended:

1. I. N. Sneddon, the use of integral transform, McGraw Hill, 1972.
2. Murray R. Spiegel, Laplace transform, Schaum's Series.

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B.Sc.(HONOURS) : PART-II

Semester: IV

SUBJECT: MATHEMATICS

PAPER: HONORS-II/Subsidiary(A)

Session 2020-2021

TITLE: STATICS & DYNAMICS

SYLLABUS

STATICS

Composition and resolution of forces. Parallel forces. Moments and Couples. Analytical conditions of equilibrium of coplanar forces. Common Catenary. Forces in three dimensions. Poinots central axis, wrenches, null lines & null planes.

DYNAMICS

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings. Motion on smooth and rough plane curves. Motion in Resisting Medium.

Books Recommended:

1. S. L. Loney, Statics, Macmillan Company, London.
2. R. S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
3. S. L. Loney, An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956.
4. F. Chorlton, Dynamics, CBS Publishers, New Delhi.
5. A. S. Ramsey, Dynamics Part-1 & 2, CBS Publisher & Distributors.

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Institute for Excellence in Higher Education (IEHE), Bhopal

S-462(B) (R-17)

B.A/B.Sc.(HONOURS) : PART-II

Semester: IV

SUBJECT: MATHEMATICS

PAPER: HONOURS-II/SUBSIDIARY (B)

Session 2020-2021

TITLE: PARTIAL DIFFERENTIAL EQUATIONS

SYLLABUS

Partial differential equations:

Formation of Partial differential equations, order and degree of Partial differential equations, Linear and Non-Linear Partial differential equations of the first order. Different types of solutions of Partial differential equations - Complete solution, singular solution, General solution,

Lagrange's linear partial differential equations and its solution., standard forms-I, II, III, IV of partial differential equations. Charpit's general method of solution of Partial differential equations.

Linear partial differential equations of second and higher orders - solution of Linear partial differential equations of second order by inspection method, by reduction to canonical forms.

Classification of Linear partial differential equations, Homogeneous and non-homogeneous equations with constant co-efficients- Finding C.F. and P.I. and solutions. Partial differential equation with variable coefficients reducible to equations with constant coefficients, their complimentary functions and particular Integrals, Monge's Method

Fourier Series:

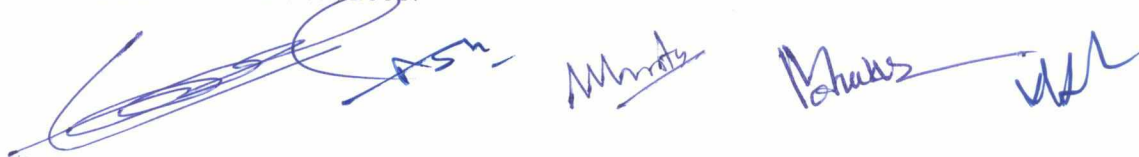
Piecewise Continuous functions, The basic Fourier series. The basic cosine series, The basic sine series,

Boundary value problems (solution by separable of variables method & Fourier Series):

Derivation and solution of one dimensional Heat conduction equation and solution of problems based on it. Derivation and solution of one dimensional wave equation and solution of problems based on it.

Books Recommended:

1. D. A. Murray: Introductory Course on Differential Equations, Orient Longman, (India), 1967
2. Erwin Kreyszing: Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
3. A. R. Forsyth: A Treatise on Differential Equations, Macmillan and Co. Ltd.
4. I. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company, 1988
5. Frank Ayres: Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972
6. R. V. Churchill, J. W. Brown: Fourier Series and boundary value problems, McGraw Hill International edition, 1987.
7. J. W. Brown, R. V. Churchill: Fourier Series and boundary value problems, Tata McGraw Hill Edition, 2008.



B.Sc.(HONOURS) : PART-III

Semester: V

SUBJECT: MATHEMATICS

PAPER: Honors-I

Session 2020-2021

TITLE: ADVANCED MECHANICS

SYLLABUS

STATICS

Stable and unstable equilibrium. Friction, Centre of gravity, virtual work.

DYNAMICS

Central Orbits:

Determination of the Orbit, The Inverse Problem, Differential Equation of Central Orbits, Kepler's Law of Motion.

Motion of Particle in Three Dimensions:

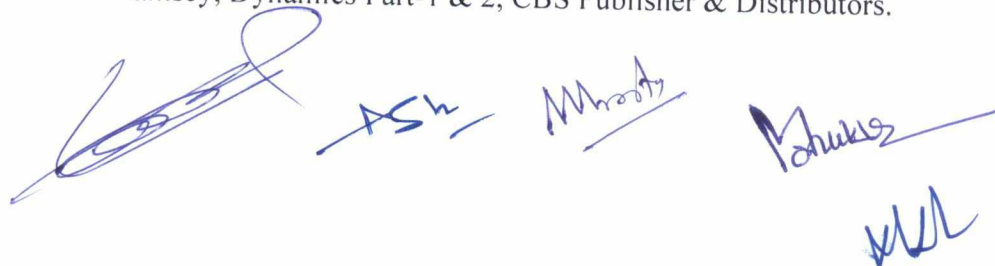
Acceleration in terms of Polar Co-ordinates, Acceleration in terms of Cylindrical Co-ordinates, Acceleration in terms of Cartesian Co-ordinates

ATTRACTION AND POTENTIAL

Attraction of a rod, attraction of a disc at a point, attraction of a spherical shell and a solid sphere. Potential of a rod, potential of a spherical shell and a solid sphere. The work done by mutual attractive forces, Gauss' theorem, Poisson' Equation, Laplace's theorem, Distribution of matter, Equipotential Surfaces.

Books Recommended:

1. S. L. Loney, Statics, Macmillan Company, London.
2. R. S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
3. S. L. Loney, An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956.
4. F. Chorlton, Dynamics, CBS Publishers, New Delhi.
5. A. S. Ramsey, Dynamics Part-1 & 2, CBS Publisher & Distributors.



Institute for Excellence in Higher Education (IEHE), Bhopal

S-562 (A) (R-18)

B.Sc.(HONOURS): PART-III

Semester: V

SUBJECT: MATHEMATICS

PAPER: Honors-II/SUBSIDIARY(A)

Session 2020-2021

TITLE: REAL ANALYSIS

SYLLABUS

Real numbers; Axiomatic introduction of real numbers, Bounded and Unbounded sets of real numbers, Least upper bound(i.u.b.), Greatest lower bound (g.l.b.), Extended real number system, Ordered completeness property, 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-Weierstrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

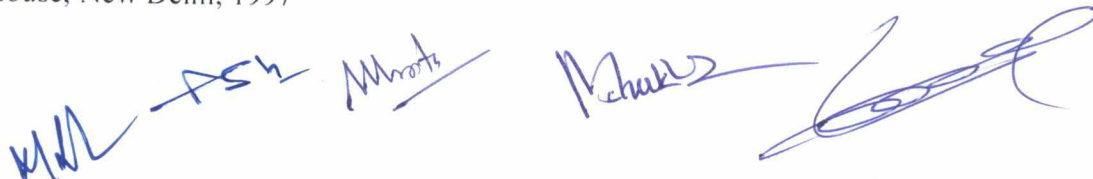
Sequence: Sequences of real numbers, Finite and infinite sequences, Bounded and Monotonic sequences, Limit of a sequence, Fundamental theorems on limits, Convergence of a sequence, Divergent sequence, Oscillating sequence, Cauchy's general principle of convergence, Limit superior and limit inferior of a sequence, Subsequences, Cauchy sequences, Cauchy's theorems on limits,

Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, , Convergence and divergence of geometric series, p-series test, D-Alembert's ratio test, Raabe's test, Logarithmic test, De-Morgan and Bertrand's test, Cauchy's root test, Cauchy's integral test, Cauchy's condensation test.

Conditional Convergence and Absolute Convergence of series, Cauchy's general principle of Convergence of series, Series with arbitrary terms, Alternating series, Leibnitz's test, Abel's lemma, Abel's test, Dirichlet's test.

Books Recommended:

1. S.C. Malik & Savita Arora: Mathematical Analysis, New Age International R.R.
2. Shanti Narayan : A Course in Mathematical Analysis, S.Chand and company, New Delhi
3. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 19704.
4. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York.
5. T. M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
6. Earl D. Rainville, Infinite Series, The Macmillan Co., New York.
7. D. Somasundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997



B.Sc.(HONOURS): PART-III

Semester: V

SUBJECT: MATHEMATICS

PAPER: HONOURS-II/SUBSIDIARY(B)

Session 2020-2021

TITLE: ABSTRACT ALGEBRA

SYLLABUS

Definition of a group with example and simple properties of groups, Subgroups and Subgroup criteria, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Lagrange's theorem and its consequences, Normal subgroups, Quotient Groups.

Homomorphisms, isomorphisms, automorphisms and inner automorphisms of a group, **Permutations groups**. Even and odd permutations. Alternating groups, Cayley's theorem.

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphism, Kernel of homomorphism, ideals and Quotient rings, Fundamental theorem of homomorphism.

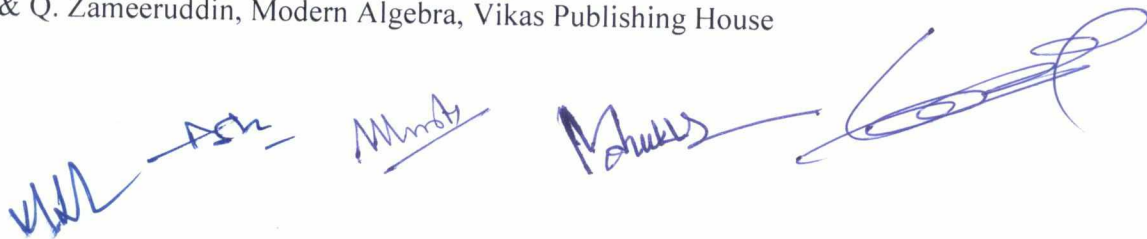
Polynomial Ring; Introduction, Determination of structure of $R[x]$, Degree of a polynomial, Degree of the sum and the product of two polynomials, Monic polynomial, Division Algorithm in $R[x]$, Remainder theorem, Factor theorem, Value of polynomial at $X=C$, zero of a polynomial, polynomial equations and their roots, Synthetic division, G.C.D, Reducible, Irreducible polynomials, Unique Factorization theorem

Books Recommended:

1. I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. A.R. Vashishtha, Krishna Prakashan Mandir, Meerut, U.P.
3. P. B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2nd edition).

Reference Books :

1. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House.
2. I. S. Luther and I.B.S. Passi, Algebra, Vol.-II, Narosa Publishing House.
3. J. B. Gallian, Abstract Algebra, Narosa Publishing House.
4. S. Singh & Q. Zameeruddin, Modern Algebra, Vikas Publishing House



Institute for Excellence in Higher Education (IEHE), Bhopal

S-661(R-18)

B.Sc.(HONOURS): PART-III

Semester: VI

SUBJECT: MATHEMATICS

PAPER: HONOURS-I

Session 2020-2021

TITLE: ADVANCED ABSTRACT ALGEBRA

SYLLABUS

Group Automorphism, Conjugacy relation and class equation of a Finite group: Introduction, Automorphism of a group, Inner Automorphism, Conjugacy relation and centralizer, Normalizer or Centralizer of an element, Counting principle and class equation of a finite group, Centre of a group.

Direct Product, Double Coset, Cauchy's and Sylow's theorems for finite abelian and non-abelian groups.

Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain, R and $R[X_1, X_2, \dots, X_n]$ as unique factorization domain.

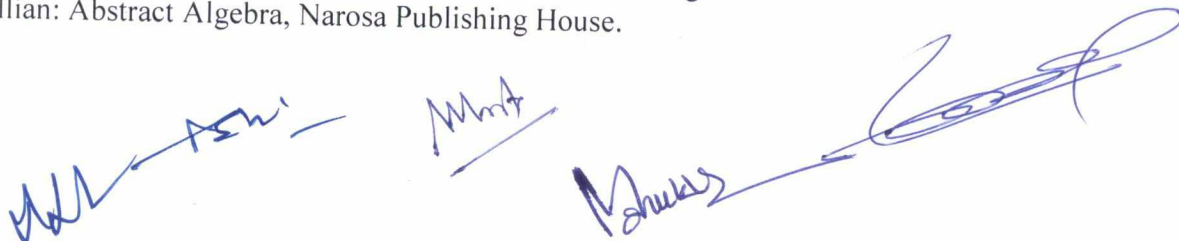
Solvable groups and Extension of Field, Separable and Inseparable extensions.

Books Recommended:

1. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. A.R. Vashishtha, Krishna Prakashan Mandir, Meerut, U.P.
3. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (2

Reference Books :

1. S. Singh & Q. Zameeruddin, Modern Algebra, Vikas Publishing House 2nd edition).
2. Vivek Sahai and Vikas Bist : Algebra, Narosa Publishing House.
3. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Narosa Publishing House.
4. J.B. Gallian: Abstract Algebra, Narosa Publishing House.



B.Sc.(HONOURS): PART-III

Semester: VI

SUBJECT: MATHEMATICS

PAPER: HONOURS-II/SUBSIDIARY(A)

Session 2020-2021

TITLE: LINEAR ALGEBRA

SYLLABUS

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 vector space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

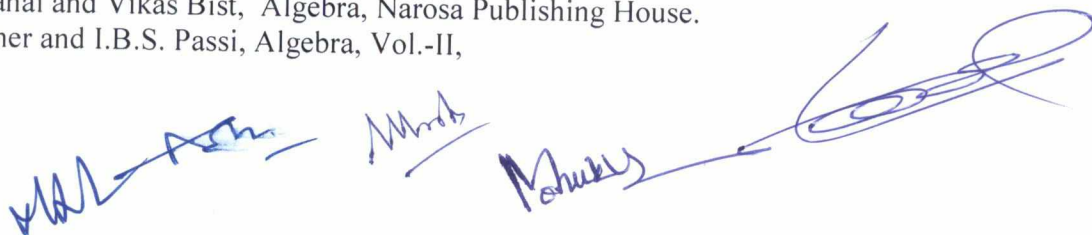
Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vector spaces, Vector space of all the linear transformations Dual Spaces, Bi-dual spaces, Dual Basis, Null Space, Range space of a linear transformation, Rank and Nullity Theorem,

Algebra of Linear 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, Diagonalisation. Bilinear and Quadratic forms.

Inner product spaces, Cauchy-Schwarz inequality, Triangular inequality, Law of parallelogram, Orthogonal vectors, Orthogonal subsets, Orthogonal sets, Bessel's inequality for finite dimensional vector spaces, **Gram-Schmidt, Orthogonalization process.**

Books Recommended:

1. K. Hoffman & R. Kunj, Linear Algebra, PHI
2. S. Lang, Linear Algebra, Springer
3. P. B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2nd edition).
4. A. R. Vasishtha, Linear Algebra, Pragati Prakashan
5. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House.
6. I. S. Luther and I.B.S. Passi, Algebra, Vol.-II,



B.Sc.(HONOURS): PART-III

Semester: VI

SUBJECT: MATHEMATICS

PAPER: HONOURS-II/SUBSIDIARY(B)

Session 2020-2021

TITLE: REAL & COMPLEX ANALYSIS

SYLLABUS

Riemann integral:

Partition, Norm of a partition, Refinement, Upper and Lower Riemann sums, Upper and Lower Riemann integrals, Properties of R-integrability, Darboux theorem, Integrability of continuous and monotonic functions, The mean value theorem, first and second mean value theorem of integral calculus, The Fundamental theorem of integral calculus.

Improper integrals:

Improper integrals and their convergence, Test for improper integral of I and II kind - Comparison tests, μ - test, Abel's and Dirichlet's tests, Convergence of integrals of a product, Absolute convergence, Frullani's integral, Integral as a function of a parameter.

Metric Space:

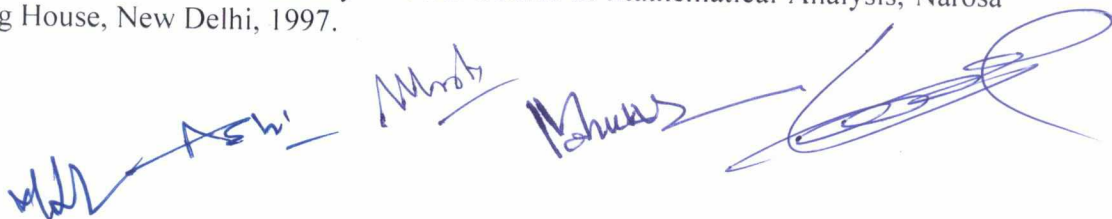
Definition and examples of metric spaces, neighbourhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness of a metric space. Cantor's Intersection Theorem.

Complex Analysis:

Extended Complex Plane, Continuity and Differentiability of complex functions, Analytic functions, Necessary condition for $f(z)$ to be analytic, Cauchy-Riemann equations, Sufficient condition for $f(z)$ to be analytic, **Harmonic functions**, Conjugate harmonic function, Polar form of Cauchy Riemann equation..

Books Recommended:

1. S. C. Malik & Savita Arora: Mathematical Analysis, New Age International.
2. Shanti Narayan : A Course in Mathematical Analysis, S.Chand and company, New Delhi
3. R. R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970.
4. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York.
5. T. M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
6. D. Somasundaram and B. Choudhary: A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.



Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. Final

S-M31 (R-18)
Semester: III

SUBJECT: MATHEMATICS

PAPER: I

Session 2020-2021

TITLE: Functional Analysis-I

SYLLABUS

Normed linear spaces, Banach spaces and examples, Properties of Normed linear spaces, Basic properties of finite dimensional normed linear spaces.

Normed linear subspaces, Equivalent norms, Riesz lemma and compactness, Quotient space of normed linear spaces and its completeness.

Linear operator, Bounded linear operators and Continuous operators, Non-linear operators.

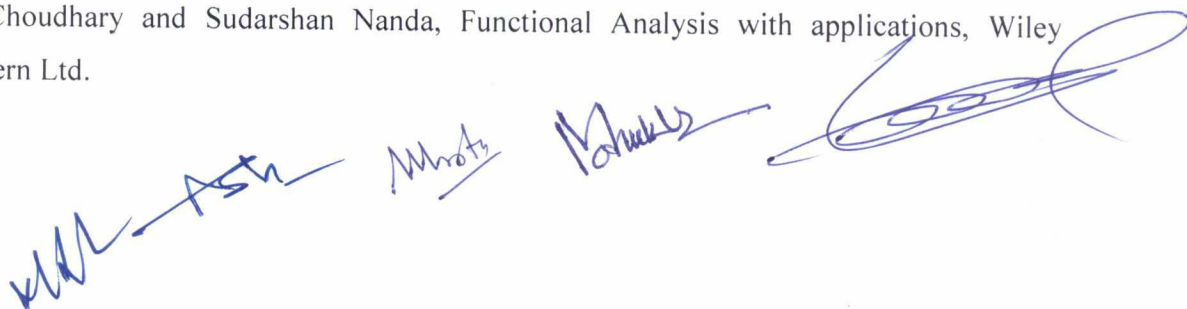
Linear functional, Bounded linear functional, Dual space with examples.

Recommended Books

1. E. Kreyzig, Introductory Functional Analysis with applications, John Wiley and Sons, New York.
2. G. F. Simmons, Introduction to Topology and Modern Analysis Mc Graw Hill, New York.

References Books

- B. Choudhary and Sudarshan Nanda, Functional Analysis with applications, Wiley Eastern Ltd.



M.Sc. Final

S-M32 (R-18)

Semester: III

SUBJECT: MATHEMATICS

PAPER: II

Session 2020-2021

TITLE: Fuzzy Sets and Their Applications-I

SYLLABUS

An overview of crisp sets, Definition of Fuzzy set, Types of Fuzzy sets, α -cut (α -level set), Strong α -cuts, Support of a Fuzzy set, Height, Normal and Sub-normal Fuzzy sets, Convex Fuzzy sets, Cutworthy property, Cardinality of fuzzy set, Sigma count, Equilibrium points of Fuzzy sets, Basic operations on Fuzzy sets. Fuzzy subset, Degree of subethood, Hamming distance (Art. 1.2, 1.3, 1.4 of Chapter 1 of [1])

Properties of α -cuts, Representations of Fuzzy sets in terms of α -cuts, First, Second and Third Decomposition theorems, Extension principle for Fuzzy sets. (Art. 2.1, 2.2, 2.3 of Chapter 2 of [1])

Operations on Fuzzy sets - Fuzzy complements, Sugeno class of fuzzy complement, Yager class of fuzzy complement, Equilibrium of fuzzy complement, Dual point, Increasing and decreasing generators, First and Second characterization theorems of Fuzzy complements, Fuzzy intersection (t-norm), Archimedean t-norm, Standard intersection, Algebraic product, Bounded difference, Drastic intersection Characterization theorem of t-norm, Fuzzy unions (t-co-norm), Archimedean, Standard union, Algebraic sum, Bounded sum, Drastic union, Characterization theorem of t-co-norm, Combinations of operations. (Art. 3.1, 3.2, 3.3, 3.4, 3.5 of Chapter 3 of [1])

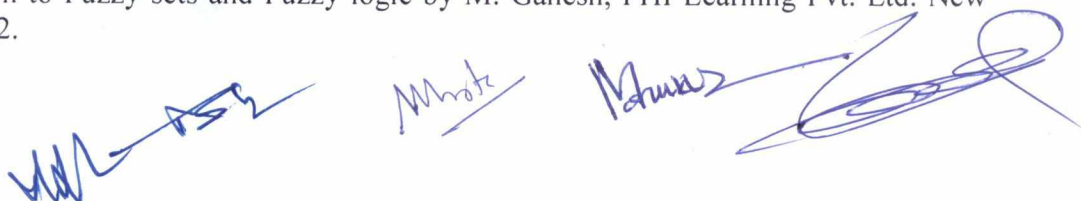
Fuzzy Arithmetic : Fuzzy numbers, Arithmetic operations on intervals, Arithmetic operations on Fuzzy numbers, Lattice of Fuzzy numbers, Fuzzy equations. (4.1, 4.3, 4.4, 4.5, 4.6 Chapter 4 of [1])

Recommended Books :

1. Fuzzy sets and Fuzzy logic by G.J. Klir and B. Yuan, Prentice- Hall of India, New Delhi, 2012.
2. Fuzzy set theory and its applications by H.J. Zimmermann, Allied Publishers Ltd., New Delhi, 1991.

Reference Books :

- Fuzzy sets and Uncertainty and Information by G.J. Kalia Tina A. Folger, Prentice Hall of India New Delhi, 2013.
- Introduction to Fuzzy sets and Fuzzy logic by M. Ganesh, PHI Learning Pvt. Ltd. New Delhi, 2012.



M.Sc. Final

Semester: III

SUBJECT: MATHEMATICS

PAPER: III

Session 2020-2021

TITLE: Operations Research-I

SYLLABUS

Operation Research and its scope, Origin and Development of operations research, Characteristics of Operation Research. (Chap.-I of I)

Model in Operations Research, Phase of Operations Research, Uses and Limitations of Operations Research,

Linear Programming Problems: Mathematical formulation, Graphical solution method. (Chap. 2 and 3 of I)

General Linear Programming Problem: Simplex method, exceptional cases, artificial variable technique, Big-M method, Two-phase method and cyclic problem, problem of degeneracy. (Chap 3 and 4 of I)

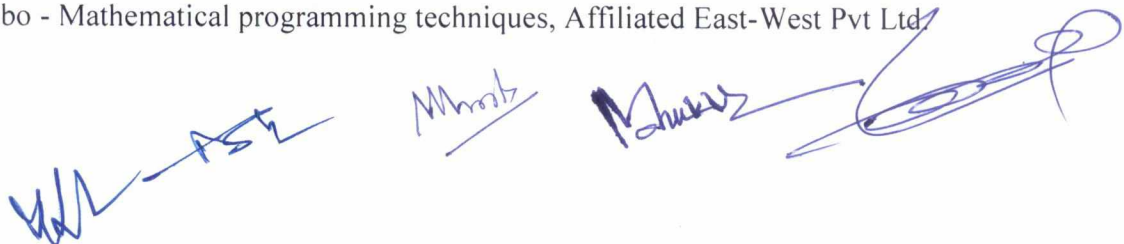
Duality, fundamental properties of duality and theorem of duality (Chap. 5 of I)

Text Books

1. Kanti Swarup, P.K. Gupta and Manmohan : Operations Research, Sultan Chand and Sons, New Delhi

Reference Books

1. S.D. Sharma - Operations Research
2. F.S. Hiller and G.J. Lieberman : Industrial Engineering series, 1995
3. G. Hadley : Linear Programming Narosa Publishing House, 1995
4. G. Hadley - Linear and Dynamic programming Addison - Wesley Reading Mass.
5. H.A. Taha - Operations Research - An introduction, Macmillan Publishing Co, Inc. New York
6. Prem Kumar Gupta and D.S. Hira - Operations Research an introduction, S.Chand and Company Ltd. New Delhi.
7. N.S. Kambo - Mathematical programming techniques, Affiliated East-West Pvt Ltd.



Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. Final

S-M34 (N-18)

Semester: III

SUBJECT: MATHEMATICS

PAPER: IV

Session 2020-2021

TITLE: Spherical Trigonometry

SYLLABUS

Fundamental of Spherical Trigonometry, Spherical Triangles, Polar Triangles.(Chapter I)

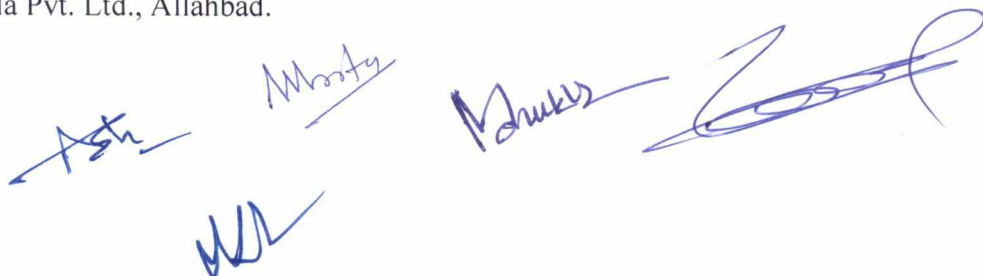
Relation between Sides & angles of a Spherical triangle, Oblique angled triangles. (Chapter II & IV)

Solution and Properties of right angled triangles. (Chapter III)

Area of a Triangle, Spherical Excess, Cagnoli's theorem, L-Huilier's theorem and Various formulae, Location of a point on Earth's Surface. (Chapter VI)

Books Recommended:

- 1 A text book of spherical trigonometry: Todhunter Revised by Gorakh Prasad and N. Saran, Pothishala Pvt. Ltd., Allahbad.



M.Sc. Final

S-M34 (R-18)

Semester: III

SUBJECT: MATHEMATICS

PAPER: IV

Session 2020-2021

TITLE: Integral Transforms-I

SYLLABUS

Introduction to Laplace Transform and inverse Laplace transform, Transform of derivatives, Linearty property. Shifting theorems. Change of scale property. Convolution theorem.

Application of Laplace transform to differential equations and integral equations including initial and boundary value problems.

Application of Laplace transforms to wave equation in one dimension, Application of Laplace transform to electric circuits.

Application of Laplace transform to beams and heat conduction equation in one dimension.

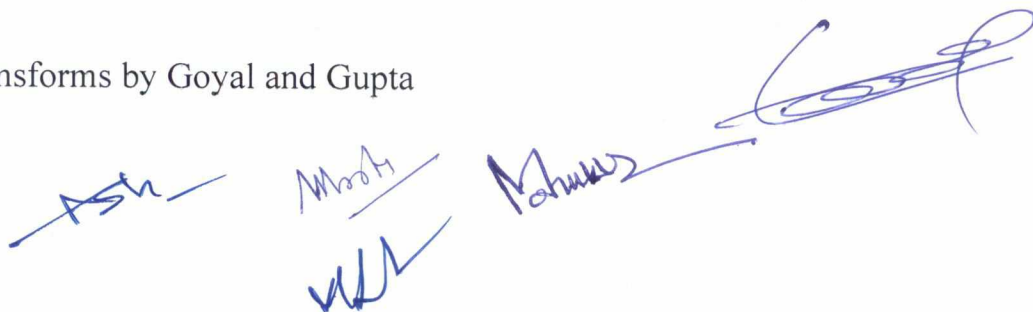
Text Books

Integral Transforms by Sneddon.

Integral Transforms by Vashishtha - Gupta Krishna Prakashan Mandir.

Reference Books

Integral Transforms by Goyal and Gupta

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S-M35 (N-16) [Partial Differential Equations]
Institute for Excellence in Higher Education (IEHE), Bhopal
M.Sc. Final

Semester: III

SUBJECT: MATHEMATICS

PAPER: V

Session 2020-2021

TITLE: PARTIAL DIFFERENTIAL EQUATIONS -I

SYLLABUS

Transport Equation-Initial Value Problem Non-homogeneous equations, Laplace's Equations - Fundamental Solution.

Mean Value Formula properties of Harmonic functions, Green's Functions. Energy Methods.

Heat Equation - Fundamental Solution, Mean Value Formula, Properties of Solutions, Energy Methods.

Wave Equation - Solution by Spherical Means, Non - homogeneous Equations, Energy Methods.

Recommended Books:

- L. C. Evans, Partial Differential Equations, 1998.

Ash *Mishra* *Mishra* *2003*

Session 2020-2021

TITLE: Advanced Special Functions - I

SYLLABUS

Gamma and Beta Functions: The Euler or Mascheroni Constant γ , Gamma Function, A series for $\Gamma'(z) / \Gamma(z)$, Difference equation $\Gamma(z+1) = z\Gamma(z)$.

Beta function, value of $\Gamma(z)\Gamma(1-z)$, Factorial Function, Legendre's duplication formula, Gauss multiplication theorem.

Hypergeometric function: Function ${}_2F_1(a, b; c; z)$. A simple integral form evaluation of ${}_2F_1(a, b; c; z)$.

Contiguous function relations, Hyper geometrical differential equation and its solutions, $F(a, b; c; z)$ as function of its parameters, Elementary series manipulations, Simple transformation, Relations between functions of z and $1-z$.

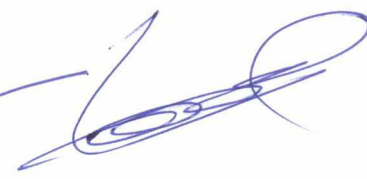
Bessel function: Definition of $J_n(z)$, Bessel's differential equation, Generating function, Bessel's integral with index half and an odd integer,

Books Recommended:

1. Rainville, E.D. ; Special Functions, The Macmillan co., New york 1971,
2. Saran, N., Sharma S.D. and Trivedi - Special Functions with application, Pragati prakashan, 1986.

Reference Books:

1. Lebedev, N.N, Special Functions and Their Applications, Prentice Hall, Englewood Cliffs, New jersey, USA 1995.
2. Whittaker, E.T. and Watson, G.N., A Course of Modern Anal

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. FINAL

S-M41 (R-18)

Semester: IV

SUBJECT: MATHEMATICS

PAPER: I

Session 2020-2021

TITLE: FUNCTIONAL ANALYSIS-II

SYLLABUS

Hilbert space, Orthogonal complements, Orthogonal sets and sequences, Orthonormal sets, Bessel's inequality, Complete orthonormal sets and Parseval's identity, Hilbert adjoint operator and its properties, Self adjoint operators.

Unitary and Normal operators, Positive operators, Hahn-Banach theorem for real linear spaces, Hahn-Banach theorem for complex linear spaces.

Adjoint operators on normed spaces, Relation between adjoint operator and Hilbert adjoint operator, Reflexive spaces.

Category theorem, Baire's category theorem, Uniform boundedness theorem and its applications, Open mapping and Closed graph theorems, Strong and Weak convergence in normed spaces.

Text Books:

1. E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons, New York.
2. G. F. Simmons, Introduction to Topology & Modern Analysis Mc Graw Hill, New York.

Reference:

B. Choudhary and Sudarshan Nanda. Functional Analysis with applications, Wiley Eastern Ltd.



SYLLABUS

An overview of crisp relation, Definition of Fuzzy Relation, Projections and cylindric extensions, Binary Fuzzy relations, Membership matrices, Sagittal diagram, Inverse of fuzzy relation, Composition of Fuzzy relations, Min-Max composition and its properties, Relational join, Binary fuzzy relations on a single set, Transitive closure, Fuzzy Equivalence Relation, Fuzzy Compatibility relation, Fuzzy ordering relation, Fuzzy Morphism. (Art. 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8 of Chapter 5 of [1]), Fuzzy relation equations, Partitioning, Solution methods (Art. 6.1, 6.2, 6.3, of Chapter 6 of [1]).

Fuzzy measures, Evidence theory, Basic probability assignment, Focal element, Body of evidence, Total ignorance, Dempster's rule of combination of degree of evidences, Joint probability, Projections, Marginal basic assignment, Conversion formulae in the evidence theory, Possibility theory, Necessity measure, Possibility measure, Belief measure, plausibility measure, Possibility distribution function, Non-interactive bodies of evidence, Fuzzy sets and possibility theory, Possibility theory versus probability theory. (Art. 7.1, 7.2, 7.3, 7.4, 7.5 of Chapter 7 of [1])

An overview of classical logic, Propositions, Logic variable, Logic function, Logic operations, Logic primitive, Logic formulae, Tautology, Contradiction, Inference rules, Rule of substitutions, Boolean algebra and its rules, Propositional logic, Quantifiers, Three valued logic, Multivalued logic, Infinite valued logic (Art. 8.1, 8.2 of Chapter 8 of [1])

Fuzzy propositions- Unconditional and unqualified, Unconditional and qualified, Conditional and unqualified, Conditional and qualified, Fuzzy quantifiers, Fuzzy Linguistic hedges, Inference from conditional Fuzzy proposition, Composition rule of inference, Inference from conditional and qualified propositions, Inference from quantified proposition. (Art. 8.3, 8.4, 8.5, 8.6, 8.7, 8.8 of Chapter 8 of [1])

Recommended Books :

1. Fuzzy sets and Fuzzy logic by G.J. Klir and B. Yuan Prentice – Hall of India, New Delhi, 2012.
2. Fuzzy set theory and its Applications by H.J. Zimmermann, Allied Publishers Ltd., New Delhi, 1991.

Reference Books :

- Fuzzy sets and Uncertainty and Information by G.J. Kalia Tina A. Folger - Prentice - Hall of India, 2013.
- Introduction to Fuzzy sets and Fuzzy logic by M. Ganesh, PHI Learning Pvt. Ltd. New Delhi, 2012.



S-M43 (N-12) [Operations Research]

Institute for Excellence in Higher Education (IEHE), Bhopal
M.Sc. FINAL

Semester: IV

SUBJECT: MATHEMATICS

PAPER: III

Session 2020-2021

TITLE: OPERATIONS RESEARCH-II

SYLLABUS

Transportation problems: North - West Corner Method Least – Cost Method. Vogel's Approximation Method, MODI Method, Exceptional cases and problem of degeneracy, Assignment problems.

Network analysis, constraints in Network, Construction of network, Critical Path Method (CPM) PERT, PERT Calculation, Resource Leveling by Network Techniques and advances of network (PERT/CPM).

Simulation: Monte - Carlo Simulation. Simulation of Networks , Advantage and Limitation of Simulation.

Game theory - Two persons, Zero - Sum Games, Maximix - Minimax principle, games without saddle points - Mixed strategies, Graphical solution of $2 \times m$ and $m \times 2$ games.

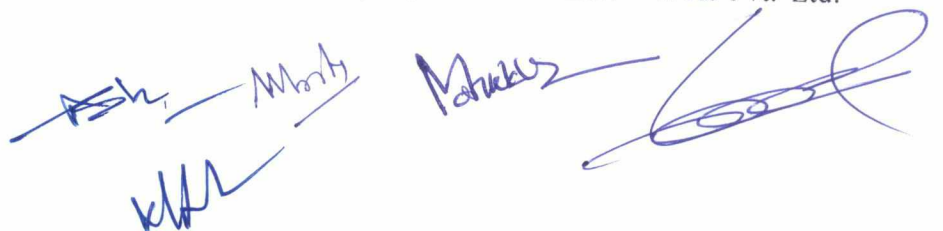
Solution by Linear Programming, Non-Linear programming Techniques: Kuhn - Tucker Conditions, Non - negative Constraints.

RECOMMENDED BOOKS

- Kanti Swarup, P.K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New delhi.

REFERENCE BOOKS

1. S.D, Sharma, Operation Research,
2. F.S, Hiller and G.J. Lieberman, Industrial Engineering Series, 1995 (This book comes with a CD containing software)
3. G. Hadley , Linear Programming, Narosa Publishing House. 1995.
4. G. Hadley, Linear and Dynamic programming, Addison - Wesley Reading Mass.
5. H.A. Taha, Operations Research - An introduction, Macmillan Publishing co. Inc. New York.
6. Prem Kumar Gupta and D.S. Hira, Operation Research, an Introduction, S.Chand & Company Ltd. New Delhi.
7. N.S. Kambo, Mathematical Programming Techniques, Affiliated East - West Pvt. Ltd. New Delhi. Madras.



Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. FINAL

S-M44 (N-18)

Semester: IV

SUBJECT: MATHEMATICS

PAPER: IV

Session 2020-2021

TITLE: Spherical Astronomy

SYLLABUS

The celestial sphere: Various systems of references, Diurnal motion of the heavenly bodies, Hour angle, Rising and setting of the stars, Motion of the sun, Twilight. (Chapter I, II & III)

Atmospheric Refraction. Astronomical instruments ; Meridian circle, Errors. (Chapter IV & V)

Kepler's law and planetary phenomena. (Chapter VI & VIII)

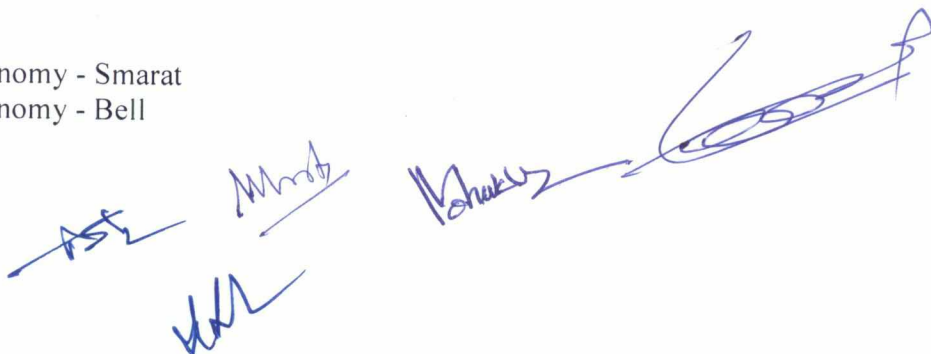
Time and Aberration. (Chapter VII & X)

Books Recommended :

- 1 A text book of spherical Astronomy: Gorakh Prasad, Pothishala Pvt. Ltd., Allahbad.

Reference Books :

1. Spherical Astronomy - Smarat
2. Spherical Astronomy - Bell

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. FINAL

S-M44 (R-18)

Semester: IV

SUBJECT: MATHEMATICS

PAPER: IV

Session 2020-2021

TITLE: INTEGRAL TRANSFORMS-II

SYLLABUS

Fourier transforms, Infinite Fourier transform, Complex Fourier transform, Linearity property, Shifting property, Change of scale property, Modulation, Convolution theorem, Fourier Transform of derivatives.

Finite Fourier transform and Fourier integral, Convolution theorem, Parseval's identity for Fourier series, Parseval's identity for Fourier transform.

Application of Fourier transform to Boundary value problems.

Introduction to Hankel and Mellin transform, Properties and examples of Hankel and Mellin transform, Relation to Fourier transform, Application of Hankel and Mellin transform to partial differential equations.

BOOKS RECOMMENDED

[1] Integral Transforms by Goyal & Gupta.

[2] Integral Transforms by Sneddon

ASH *Mishra* *Mishra* *Sharma*

Session 2020-2021

TITLE: ADVANCED SPECIAL FUNCTIONS-II

SYLLABUS

Generating function for Legendre polynomials, Recurrence relations, Rodrigues formula, Bateman's generating function, Additional generating functions, Hypergeometric forms of $P_n(x)$, Special properties of $P_n(x)$, Some more generating functions, Laplace's first integral form, Orthogonality.

Definition of Hermite polynomials $H_n(x)$, Pure recurrence relations, Differential recurrence relations, Rodrigue's formula, Other generating functions, Orthogonality, Expansion of polynomials, more generating functions.

Laguerre Polynomials: The Laguerre Polynomials $L_n(x)$, Generating functions, Pure recurrence relations, Differential recurrence relation, Rodrigue's formula, Orthogonal, Expansion of polynomials, Special properties, Other generating functions.

Books Recommended:

1. Rainville, E.D. ; Special Functions, The Macmillan co., New york 1971,
2. Saran, N., Sharma S.D. and Trivedi - Special Functions with application, Pragati prakashan, 1986.

Reference Books:

1. Lebedev, N.N, Special Functions and Their Applications, Prentice Hall, Englewood Cliffs, New jersey, USA 1995.
2. Whittaker, E.T. and Watson, G.N., A Course of Modern Anal

S-M45 (N-16) [Partial Differential Equations]

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. FINAL

Semester: IV

SUBJECT: MATHEMATICS

PAPER: V

Session 2020-2021

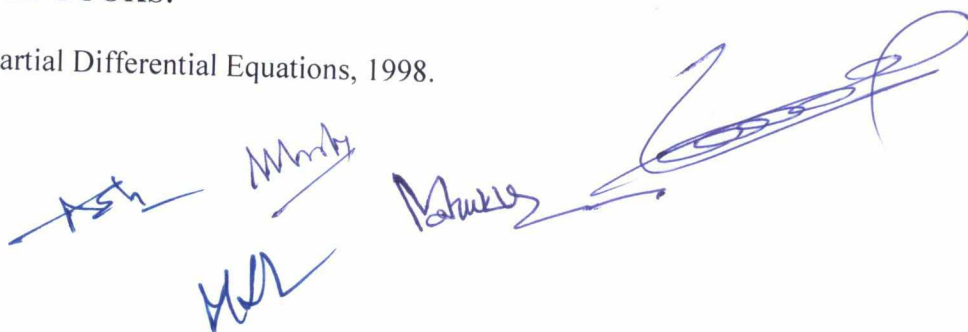
TITLE: PARTIAL DIFFERENTIAL EQUATIONS -II

SYLLABUS

Nonlinear First order PDE. Complete integrals, Envelopes, Characteristics.
Hamilton Jacobi Equation (Calculus) of Variations, Hamiltons ODE, Legendre Transform, Hopf-Lax formulae, weak solution, Uniqueness.
Conservation Laws (Shocks, Entropy Condition Lax - Oleinik formula, Weak solutions, Uniqueness. Riemanns Problem Long Time behavior) Representation of Solution - Separation of Variables, Similarity Solutions (Plane and Traveling Waves - Solution.
Similarity under Scaling Fourier and Laplace Transform, Hopf - Cole Transform, Hodograph and Legendre Transforms, Potential Functions, Asymptotes (Singular Perturbations, Laplace Method, Geometric Optics.
Stationary Phase Homogenization) Power Series (Non - characteristic surface, Real Analytic functions, Cauchy - Kovalevskaya Theorem.

RECOMMENDED BOOKS:

1. L.C. Evans, Partial Differential Equations, 1998.



M.Sc. PREVIOUS

Semester: I

SUBJECT: MATHEMATICS

PAPER: I

Session 2020-2021

TITLE: ADVANCED ABSTRACT ALGEBRA-I

SYLLABUS

Normal series, composition series, Jordan Holder Theorem, Solvable and Nilpotent groups (Chapter-6).

Algebraic extensions of field, Adjunction of roots, Algebraic and transcendental extensions, Algebraically closed fields. (Chapter-15)

Splitting fields, Normal extensions, Multiple roots, finite fields, separable extensions, Automorphism of extensions, Galois extension, fundamental theorem of Galois theory, Fundamental theorem of Algebra (Chapter- 16 &17).

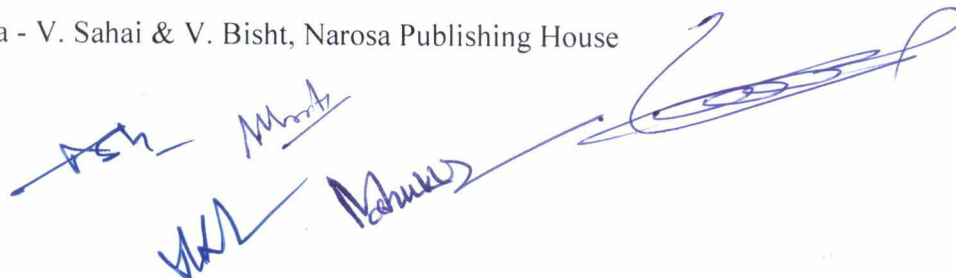
Roots of unity, Cyclic extensions, Polynomials solvable by radicals. (Chapter-18)

RECOMMENDED BOOKS :

1. P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul, Basic Abstract Algebra, Cambridge University Press.

REFERENCE BOOKS :

1. Topics in Algebra - I.N. Herstein, Wiley Eastern, New Delhi
2. Algebra - V. Sahai & V. Bisht, Narosa Publishing House



Institute for Excellence in Higher Education (IEHE), Bhopal

S-M12 (R-18)

M.Sc. PREVIOUS

Semester: I

SUBJECT: MATHEMATICS

PAPER: II

Session 2020-2021

TITLE: REAL ANALYSIS

SYLLABUS

Definition and existence of Riemann- Stieltjes integral and its properties, Relation between Riemann integration and Riemann- Stieltjes integration, Mean Value theorem, Integration and differentiation, The Fundamental theorem of Calculus. Integration of vector -valued functions, Rectifiable curves.

Sequences and series of functions. pointwise convergence, uniform convergence of sequences and series, M_n -test for uniform convergence of sequences, Weierstrass M- test, Abel's test, Dirichlet's test, Uniform convergence and continuity. Uniform convergence and RS-integration. Uniform convergence and differentiation. Weierstrass Approximation theorem.

Functions of several variables, Linear Transformations. Matrices Derivatives in an open subset of $\mathbb{R}^n$, Chain rule, Partial Derivatives, Continuously Differentiable function, Contraction Principle.

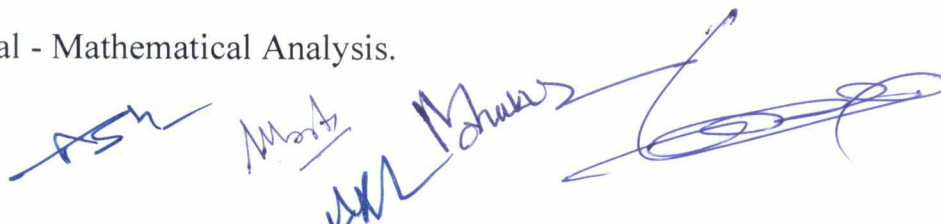
Inverse function theorem The implicit function theorem, Implicit function theorem (Linear version), Jacobians, Differentiation of integrals, Partition of Unity.

Text Book

- Walter Rudin- Principles of Mathematical Analysis- Mc Graw Hill

REFERENCE

- T.M. Apostol - Mathematical Analysis.



M.Sc. PREVIOUS

Semester: I

SUBJECT: MATHEMATICS

PAPER: III

Session 2020-2021

TITLE: TOPOLOGY-I

SYLLABUS

Countable and uncountable sets. Infinite sets and Axiom of Choice. Schroeder-Bernstein theorem. Zorn's lemma. Well-ordering theorem. (As given in chapter - I, Article No. 7, 9 & 10 of J. R. Munkers's book)

The definition and some examples of topological spaces. Topological subspace, limit point, derived set. Elementary concepts of open sets, closed sets, closure of a set, dense set, everywhere dense and nowhere dense set. Neighbourhood of a point on a set in a topological spaces, Open base, Isolated point of a set, Interior, Exterior and Boundary points of a set. (As given in chapter - I, Article No. 12 to 17 of J. R. Munkers's book)

Continuous maps and homeomorphism of topological spaces. An open base and open sub-base for topological spaces. (As given in the Chapter-II of G. F. Simmons's Book)

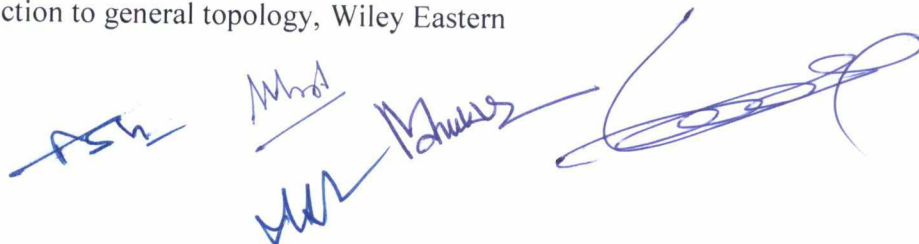
First and Second Countable spaces. Lindelof's theorems. Separable spaces, Disconnected and Connected sets and spaces. Connectedness on Real line, Components, totally disconnected spaces, Locally connected spaces. (As given in the Chapter - III & VI of G.F. Simmons's Book)

Text Books:

1. J.R. Munkres, Topology- A first course, Prentice-Hall of India.
2. G.F. Simmons: Introduction to Topology and Modern Analysis

Reference books :

1. K.D. Joshi: Introduction to general topology, Wiley Eastern



M.Sc. PREVIOUS

Semester: I

SUBJECT: MATHEMATICS

PAPER: IV

Session 2020-2021

TITLE: COMPLEX ANALYSIS-I

SYLLABUS

Complex integration. Riemann Stieltjes integral. Power series representation of analytic Functions. Cauchy's Estimate Zeros of an analytic function.

Liouville's theorem, Fundamental Theorem of Algebra, Maximum Modulus Theorem, Index of a closed curve, Cauchy's Theorem and integral formula (First Version only), Morera's Theorem, Counting zeros, open mapping theorem. Goursat's theorem (As Given in chap. IV of text book)

Singularities. Classification of singularities, Laurent series, Weierstrass Theorem. Residues. Residue theorem. Argument Principle, Rouché's Theorem (As given in Chap V of text book)

Maximum Modulus Theorem. Schwarz's lemma (As given in chap VI of T.B) Möbius Transformation, their properties and classification. Definition and examples of **Conformal Mapping**

Text Book

- J. B. Conway, Functions of one complex variable, second Edn., Springer International student Edn.

References:

1. L.V. Ahlfors - complex analysis Mc Graw Hill
2. S. Ponnuswamy Foundations of complex analysis Narosa Publishing house.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. PREVIOUS

Semester: I

SUBJECT: MATHEMATICS

PAPER: V

Session 2020-2021

TITLE: Advanced Discrete Mathematics-I

SYLLABUS

Semigroups and Monoids: Definition, Homomorphism of semi groups and Monoids, Quotient Semigroups, Subsemigroups and submonoids, Direct products (Art 3.2 of [1])

Lattices as partially ordered sets: Definitions, their properties, lattice as Algebraic systems, sublattices, Direct products and Homomorphisms, Some special lattices. (Art 4.1 of [1])

Boolean Algebra: Definitions, various Boolean Identities, subalgebra, Direct product and Homomorphism (Art 4.2 of [1])

Boolean functions: Boolean forms and free Boolean Algebras, values of Boolean expressions and Boolean functions. (Art 4.3 of [1]).

Representation and minimization of Boolean functions (Art 4.4 of [1])

Definitions of graphs, subgraphs, degree of a vertex, paths, circuits, walk, connectivity, Euler graph, complete graph, Trees, Spanning trees, Cut-sets, Fundamental Cut-sets, Fundamental circuits, Minimal spanning trees and Kruskal's Algorithm (Art 1.1-1.5, 2.2, 2.4-2.7, 3.1-3.2, 3.7, 3.8, 3.10, 4.1, 4.2-4.5 of [2])

Planar graphs and their properties, Euler's formula for connected planar graphs, Kuratowski's two graphs (statement only) and its use, matrix representation of graphs (Incidence matrix, Cut-set matrix, Circuit matrix) (Art. 5.2-5.4, 7.1, 7.3, 7.6 of [2])

Recommended Text Book

1. J. P. Tremblay and R. Manohar, Discrete Mathematics Structure, Mc-Graw Hill
2. Narsingh Deo, Graph Theory with applications, Prentice Hall

Handwritten signatures of the authors and reviewers, including 'J.P. Tremblay', 'R. Manohar', and 'Narsingh Deo'.

M.Sc. PREVIOUS

Semester: II

SUBJECT: MATHEMATICS

PAPER: I

Session 2020-2021

TITLE: ADVANCED ABSTRACT ALGEBRA-II

SYLLABUS

Introduction to Modules, examples, submodules, quotient modules, homomorphism, isomorphism, cyclic modules, simple modules, free modules, Schur's Lemma (Ch-14)

Noetherian and artinian module, Hilbert basis theorem, Wedderburn –Artin theorem, Uniform modules, Primary modules, Noether-Laskar theorem. (Ch-19)

Fundamental theorem of modules over a principle ideal domain and its applications to finitely generated abelian groups (Ch-21)

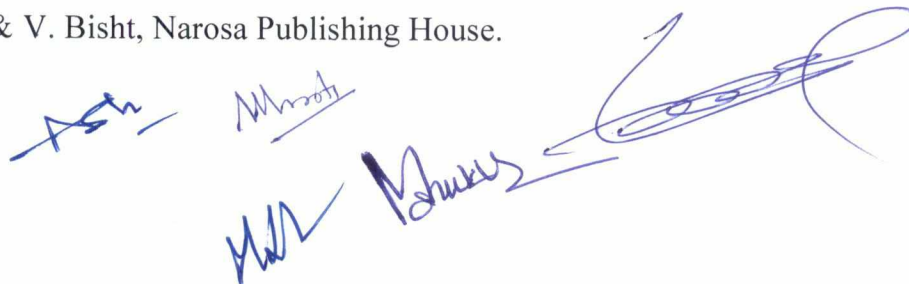
Smith normal form over a PID and rank (Ch-20), Rational Canonical form, Jordan form (Ch-21)

TEXT BOOKS

Basic Abstract Algebra – P.B. Bhattacharya, S.K. Jain, S.R. Nagpaul, Cambridge Univ. Press

REFERENCES

1. Topics in Algebra – I.N. Herstein, Wiley Eastern, New Delhi.
2. Algebra – V. Sahai & V. Bisht, Narosa Publishing House.



Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. PREVIOUS

S-M22 (R-18)

Semester: II

SUBJECT: MATHEMATICS

PAPER: II

Session 2020-2021

TITLE: LEBESGUE MEASURE AND INTERGRATION

SYLLABUS

Lebesgue outer measure, F_σ and G_δ - sets, Algebra of sets, σ - algebra, Measurable sets and Lebesgue measure, Measurability of Borel sets, Fundamental theorem, Non-measurable sets.

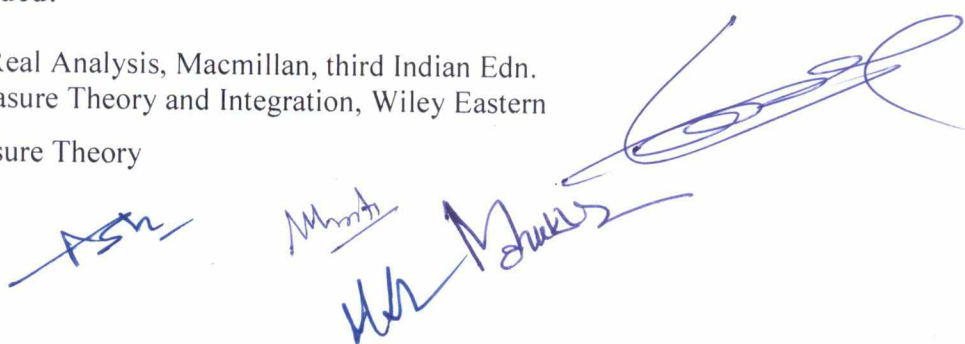
Measurable functions, Properties of Lebesgue measurable functions, Step functions, Simple function, Operations on measurable functions, Characteristic function, Borel measurable function.

Integral of a bounded function over a set of finite measure, Lebesgue integral, Riemann and Lebesgue integrals, Properties of Lebesgue integral for bounded measurable functions, Lebesgue Bounded convergence theorem, Fatou's lemma, Monotone convergence theorem, Integration of series, Integrable functions, General Lebesgue integral, Lebesgue dominated convergence theorem.

L^p -space, Convex functions, Conjugate numbers, Jensen's inequality, Holder inequalities and Minkowski inequality for L^p -spaces Completeness of L^p -spaces, onvergence in measure, Riesz's theorem, Almost uniform convergence, Egroff theorem, Riesz-Fischer theorem.

Books Recommended:

1. H. L. Royden – Real Analysis, Macmillan, third Indian Edn.
2. G. de Barra, Measure Theory and Integration, Wiley Eastern
3. P. Halmos, Measure Theory



Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. PREVIOUS

S-M23 (R-18)

Semester: II

SUBJECT: MATHEMATICS

PAPER: III

Session 2020-2021

TITLE: TOPOLOGY-II

SYLLABUS

Compactness: Continuous functions and compact sets. Basic properties of Compactness. Compactness and Finite Intersection Property. Product of spaces, Projection maps, Tychonoff's theorem, Local compactness. Alexander subbase theorem, Heine Borel theorem. Compactness in metric spaces. BWP, Sequentially Compact Metric spaces. Lebesgue covering lemma (As given in the chapter-IV of G. F. Simmons's Book)

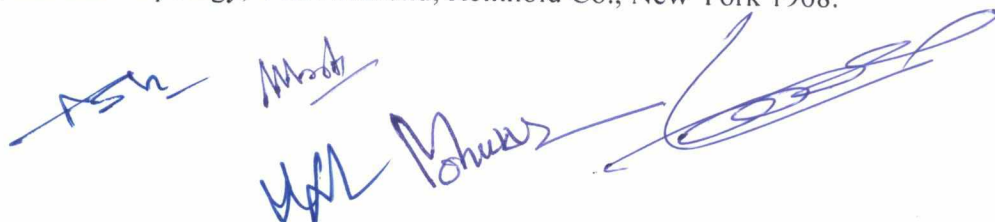
Separation: T_0 , T_1 -spaces, Hausdorff spaces, Regular, Completely regular spaces and Normal spaces; their characterizations and basic properties. (As given in the Chapter-V of G. F. Simmons's Book)

Urysohn's Lemma. Tietze extension theorem, one point compactification, the Stone Cech Compactification, Urysohn Metrization Theorem (As given in the Chapter-V of G.F. Simmons's Book)

Net the filters: Topology and convergence of nets, Hausdorffness and Compactness of nets, Filters and their convergence, Ultra-filters and compactness. (As given "General Topology by J.L. Kelley, Chapter-2 page 65-75). The fundamental group and covering spaces- Homotopy of paths. The fundamental group. covering spaces. (As given in chapter - IX, article no. 51 to 54 of James R. Munkres's Book)

BOOKS RECOMMENDED:

1. James R. Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd., New Delhi.
2. G. F. Simmons. Introduction to Topology and Modern Analysis, McGraw-Hill Book Company.
3. J. L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York 1968.



Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. PREVIOUS

S-M24 (R-18)

Semester: II

SUBJECT: MATHEMATICS

PAPER: IV

Session 2020-2021

TITLE: COMPLEX ANALYSIS-II

SYLLABUS

Weirstrass factorization Theorem. Gamma functions and its properties, Riemann zeta function, Riemann Functional equation [As given in Chap-VII of T.B., Article 5, 6, 7, 8] Runge's Theorem. Mittag Leffler's Theorem [As given in chap.-VIII of T.B.]

Analytic Continuation, Schwarz Reflexion principles, Monodromy Theorem. Harmonic function on Disc. [As given in chap. IX and X of T.B.] Harnack Inequality and Theorem,

Dirichlet's problem. Green function (as given in Chap.X of T.B.), Entire function. Jensen's Formula, Poisson's formula, genus and order of an entire function. (Chap-XI of T.B.),

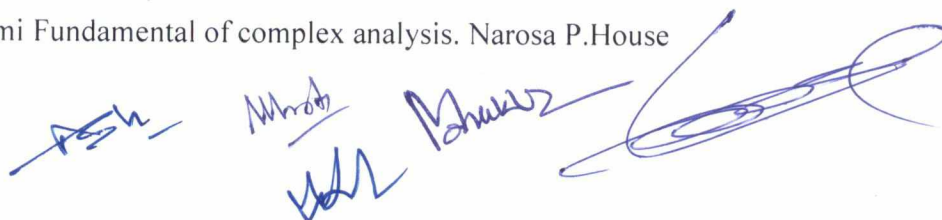
Hadamard Factorization Theorem (Chap-XI of T.B.), Range of an analytic function, Bloch's Theorem. The little Picard's Theorem. Schottky's Theorem. Montel Caratheodory Theorem. Great Picard Theorem. [Chap. XII of T.B.]

Text Book

- J.B. Conway, function of one complex variable (second edn.), Spring Verlag

Reference

1. L.V. Ahlfors, Complex Analysis, McGraw Hills
2. S. Ponnuswami Fundamental of complex analysis. Narosa P.House



M.Sc. PREVIOUS

Semester: II

SUBJECT: MATHEMATICS

PAPER: V

Session 2020-2021

TITLE: ADVANCE DISCRETE MATHEMATICS-II

SYLLABUS

Finite State Machines and their Transition Table Diagrams, Equivalence of Finite State Machines, Reduced Machines, Homomorphism (Art 4.6 of [1])

Finite Automata, Acceptors, Non-deterministic, Finite Automata and Equivalence of its power to that of Deterministic Finite Automata (Art 6.1 of [1])

Turing Machines and Partial Recursive Functions. (Art 6.2 of [1])

Grammers and Languages (Art 3.3 of [1])

Polish Expression and their compilations (Art 3.4 of [1])

Directed Graphs, Indegree and Outdegree of a Vertex, Weighted Undirected Graphs, Dijkstra's algorithm, Strongly Connected Digraphs.

Matrix representation for a Digraphs (incidence matrix, cut-set matrix, circuit matrix Art 9.1, 9.2, 9.4 9.8 of [2])

Recommended Tex Books

1. J. P. Tremblay & R. Manohar, Discrete Mathematical Structures, Mc Graw Hill.
2. Narsingh Deo, Graph Theory with applications, Prentice Hall.

