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 2018-2019

TITLE: DISCRETE MATHEMATICS

SYLLABUS

Logics and Propositional Calculus:

Propositions, Compound propositions, Basic logical operations, Truth tables, Tautolgoies 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, Bools 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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B.Sc.(HONOURS): PART-I **Semester:** I

SUBJECT: MATHEMATICS **PAPER: HONOURS-II/SUBSIDARY (A)**

Session 2018-2019

TITLE: CALCULUS

SYLLABUS

Differential Calculus:

Successive differentiation. Convergence of series, Expansion of functions (Leibnitz theorem. Maclaurin and Taylor series expansions). Tagent 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 Gama 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 toReal 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.

B.Sc.(HONOURS): PART-I **Semester:** I

SUBJECT: MATHEMATICS **PAPER: HONOURS-II/SUBSIDARY (B)**

Session 2018-2019

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.

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 2018-2019

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 2018-2019

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 once. 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

B.Sc.(HONOURS) : PART-I **Semester:** II

SUBJECT: MATHEMATICS **PAPER: HONOURS-II/SUBSIDARY(A)**

Session 2018-2019

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 Longaman (India). 1967
2. A. R. Forsyth, A Treatise on Differential Equations, Machmillan and Co. Ltd. London.
3. E. A. Codington, 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.

27.4.18 27.04.18 27.4.18 27.4

B.Sc.(HONOURS) : **PART-I** Semester: **II**

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

Session 2018-2019

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 grad Φ, 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 Coordinary 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. Murrary R. Spiegal, Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
4. Murrary R. Spiegal, Vector Analysis, Schaum Publisghing 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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Institute for Excellence in Higher Education (IEHE), Bhopal

S-361 (N-18)

B.Sc.(HONOURS): PART-II **Semester:** III

SUBJECT: MATHEMATICS **PAPER: HONOURS-I**

Session 2018-2019

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 2018-2019

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

SUBJECT: MATHEMATICS **PAPER: HONOURS-II/SUBSIDARY(A)**

Session 2018-2019

TITLE: ADVANCED CALCULUS

SYLLABUS

Limits: $\in$-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, Lagranges'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 toReal 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 Mathemtical 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 2018-2019

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 pth 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.

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B.Sc.(HONOURS) : PART-II **Semester: IV**

SUBJECT: MATHEMATICS **PAPER: HONOURS-I**

Session 2018-2019

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.

B.Sc.(HONOURS) : PART-II **Semester:** IV

SUBJECT: MATHEMATICS **PAPER: HONORS-II/Subsidiary(A)**

Session 2018-2019

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. Poinsots 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.

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

SUBJECT: MATHEMATICS **P APER: HONOURS-II/SUBSIDARY (B)**

Session 2018-2019

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-coefficients- 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.

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B.Sc.(HONOURS) : PART-III **Semester:** V

SUBJECT: MATHEMATICS **PAPER: Honors-I**

Session 2018-2019

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 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.

S-562 (A) (R-18)

B.Sc.(HONOURS): PART-III **Semester:** V

SUBJECT: MATHEMATICS **PAPER: Honors-II/SUBSIDIARY(A)**

Session 2018-2019

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-Weiestrass 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 2018-2019

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, Largrage's theorem and its consequences, Normal subgroups, Quotient Groups.

Homomorphisms, isomophisms, 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

B.Sc.(HONOURS): PART-III **Semester:** VI

SUBJECT: MATHEMATICS **PAPER: HONOURS-I**

Session 2018-2019

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 $R[X_1, X_2 \ldots X_n]$ 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 House2nd edition).
2. Vivek Sahai and Vikas Bist : Algebra, NKarosa Publishing House.
3. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Norsa 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 2018-2019

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,

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B.Sc.(HONOURS): PART-III **Semester:** VI

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

Session 2018-2019

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, Integrabililty of continuous and monotonic functions, The mean valve 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.

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M.Sc. **PREVIOUS** Semester: **I**

SUBJECT: MATHEMATICS **PAPER: I**

Session 2018-2019

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)

RECOMMANDED 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

M.Sc. PREVIOUS **Semester:** I

SUBJECT: MATHEMATICS **PAPER: II**

Session 2018-2019

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. Weirstrass Approximation theorem.

Functions of several variables, Linear Transformations. Matrices Derivatives in an open subset of 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. Apostal - Mathematical Analysis.

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M.Sc. PREVIOUS **Semester:** I

SUBJECT: MATHEMATICS **PAPER: III**

Session 2018-2019

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. Elementry 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. Simmon'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. Simmon'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

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. **PREVIOUS** Semester: **I**

SUBJECT: MATHEMATICS **PAPER: IV**

Session 2018-2019

TITLE: COMPLEX ANALYSIS-I

SYLLABUS

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

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

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

Maximum Modulus Theorem. Schwarzs' lemma (As given in chap VI of T.B) Mobius 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.

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. PREVIOUS **Semester: I**

SUBJECT: MATHEMATICS **PAPER: V**

Session 2018-2019

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

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. PREVIOUS **Semester:** II

SUBJECT: MATHEMATICS **PAPER: I**

Session 2018-2019

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.

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M.Sc. PREVIOUS **Semester: II**

SUBJECT: MATHEMATICS **PAPER: II**

Session 2018-2019

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, Lebesque integral, Riemann and Lebesque integrals, Properties of Lebesque integral for bounded measurable functions, Lebesque 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

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Institute for Excellence in Higher Education (IEHE), Bhopal

S-M23 (R-18)

M.Sc. PREVIOUS **Semester:** II

SUBJECT: MATHEMATICS **PAPER: III**

Session 2018-2019

TITLE: TOPOLOGY-II

SYLLABUS

Compactness: Continuous functions and compact sets. Basic prosperities of Compactness. Compactness and Finite Intersection Property. Product of spaces, Projection maps, Tychonoff's theorem, Local compactness. Alexaender subbase theorem, Heine Boral theorem. Compactness in metric spaces. BWP, Sequentially Compact Metric spaces. Lebesgue covering lemma (As given in the chapter-IV of G. F. Simmon'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 Chaper-V of G. F. Simmon'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. Simmon'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 Nöstrond, Reinhold Co., New York 1968.

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Institute for Excellence in Higher Education (IEHE), Bhopal

S-M24 (R-18)

M.Sc. PREVIOUS **Semester:** II

SUBJECT: MATHEMATICS **PAPER: IV**

Session 2018-2019

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.-VIIIof 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. Jenson's Formula, Poissions 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. Schotchy'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, Me Grew Hills
2. S. Ponnuswami Fundamental of complex analysis. Narosa P.House

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M.Sc. PREVIOUS **Semester:** II

SUBJECT: MATHEMATICS **PAPER: V**

Session 2018-2019

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, Dijkastra'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.

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S-M31 (R-18)

M.Sc. **Final** Semester: **III**

SUBJECT: MATHEMATICS **PAPER: I**

Session 2018-2019

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.

S-M32 (R-18)

M.Sc. **Final** Semester: **III**

SUBJECT: MATHEMATICS **PAPER: II**

Session 2018-2019

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 subsethood, Hammimg 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), Archimedeaan 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])

Recommanded 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. Foljer , Prentice Hall of India New Delhi, 2013.
- Introduction to Fuzzy sets and Fuzzy logic by M. Ganesh, PHI Learning Pvt. Ltd. New Delhi, 2012.

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M.Sc. **Final** Semester: **III**

SUBJECT: MATHEMATICS **PAPER: III**

Session 2018-2019

TITLE: Operations Research-I

SYLLABUS

Operation Research and its scope, Origin and Development of operations research, Characteristics of Operation Research. (Chap.-I of 1)

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 1)

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 1)

Duality, fundamental properties of duality and theorem of duality (Chap. 5 of 1)

Text Books

1. Kanti Swarup, P.K. Gupta and Manmohan : Opertions 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.

M.Sc. **Final** Semester: **III**

SUBJECT: MATHEMATICS **PAPER: IV**

Session 2018-2019

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-M34 (N-18)

M.Sc. **Final** Semester: **III**

SUBJECT: MATHEMATICS **PAPER:** IV

Session 2018-2019

TITLE: Spherical Trigonometry

SYLLABUS

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

Relation between Sides & angles of a Spherical triangle, Oblique angled triangls. .(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.

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M.Sc. **Final** Semester: **III**

SUBJECT: MATHEMATICS **PAPER: V**

Session 2018-2019

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.

Hypergoemetric 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. Lebdev, 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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M.Sc. **Final** Semester: **III**

SUBJECT: MATHEMATICS **PAPER: V**

Session 2018-2019

TITLE: PARTIAL DIFFERENTIAL EQUATIONS -I

SYLLABUS

Transport Equation-Intial Value Problem Non-homogeneours equations, Laplace's Equations - Fundamental Solution.

Mean 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.

M.Sc. FINAL **Semester:** IV

SUBJECT: MATHEMATICS **PAPER: I**

Session 2018-2019

TITLE: FUNCTIONAL ANALYSIS-II

SYLLABUS

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

Unitory 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, Bair'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.

M.Sc. FINAL

Semester: IV

SUBJECT: MATHEMATICS

PAPER: II

Session 2018-2019

TITLE: FUZZY SETS AND THEIR APPLICATIONS-II

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, Possiblity 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])

Recommanded 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. Foljer - Prentice - Hall of India, 2013.
- Introduction to Fuzzy sets and Fuzzy logic by M. Ganesh, PHI Learning Pvt. Ltd. New Delhi, 2012.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. FINAL **Semester:** IV

SUBJECT: MATHEMATICS **PAPER: III**

Session 2018-2019

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×m and m×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.

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M.Sc. FINAL

Semester: IV

SUBJECT: MATHEMATICS

PAPER: IV

Session 2018-2019

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, Perseval's identity for Fourier series, Perseval'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

M.Sc. FINAL

Semester: IV

SUBJECT: MATHEMATICS

PAPER: IV

Session 2018-2019

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

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. FINAL **Semester:** IV

SUBJECT: MATHEMATICS **PAPER: V**

Session 2018-2019

TITLE: ADVANCED SPECIAL FUNCTIONS-II

SYLLABUS

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

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

Laguerre Polynomials: The Laguerre Polynomials $L_n(x)$, Generating functions, Pure recurrence relations, Differential recurrence relation, Rodrigo'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. Lebdev, 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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M.Sc. FINAL **Semester:** IV

SUBJECT: MATHEMATICS **PAPER: V**

Session 2018-2019

TITLE: PARTIAL DIFFERENTIAL EQUATIONS -II

SYLLABUS

Nonlinear First order PDE. Complete integrals, Envelopes, Characteristies.

Hamilton Jacobi Equation (Calulus) of Variations, Hamiltons ODE, Legendre Transform, Hopf-Lax formulae, weak solution, Uniqueness.

Conservation Laws (Shocks, Entropy Condition Lax - Oleinic 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 Lap lace Transform, Hopf - Cole Transform, Hodograph and Legendrey Transforms, Potential Functions, Asymptotes (Singular Perturbations, Lap laces 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.

DEPARTMENT OF MATHEMATICS

Structure of Papers for M.Phil. (Mathematics) 2018-19

M.Phil.	Paper	Title of Paper	Total Marks		Remark
			Max	Min	
Entrance Test	Paper		100		MCQ
Ist Sem Course Work	Paper-I	Research Methodology (Theory)	100	40	
	Paper-II	Review of published research in the relevant field Evaluation of Report Viva-Voce Presentation	 40 30 30	 40	
IInd Sem	Paper-I	Research Methodology (Theory)	100	40	
	Paper-II	(Choose any One) 1. Algebraic Topology & Spline Theory 2. Atomistic and Multiplicative Lattices 3. Generalized Integral Transformation 4. Numerical Analysis 5. Fluid Dynamics 6. Trellis Theory 7. Operations research 8. Mathematical Modelling	100	40	
	Paper-III	Seminar-I Seminar-II	50 50	20 20	
IIIrd Sem	Paper-I	(Choose any One) 1. Commutative Algebra 2. Theory of Fuzzy Computation 3. Theory of Near Ring 4. Theory of Choice 5. Topics in Geometric Function Theory 6. Fuzzy Measures and Integrals 7. Game theory with Economic Application 9. Graph Theory and its Applications 10. Topics in General Relativity 11. Group Analysis of Differential Equations 12. H-Function of One and Two Variables	100	40	
	Paper-II	Dissertation	100	40	
	Paper-III	Dissertation Viva-Voce Exam	100	40	

Board of Studies:

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Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) **Semester:** I

SUBJECT: MATHEMATICS **PAPER: RESEARCH METHODOLOGY**

Session 2018-2019

TITLE: **RESEARCH METHODOLOGY**

SYLLABUS

Introduction of Research Methodology: Meaning of research, objectives of research, types of research, Motivation in research, significance of research, Research Approaches, research and scientific method, research process, Criteria of Good Research.

Research Problem: Definition, Selection of problem, Identification of problem, necessity and techniques of defining research problem. Formulation of research problem. Objectives of research problem.

Research Design: Meaning, need and features of good research design. Types of Research Designs. Synopsis design for research topic. Developing a Research Plan.

Presentation: Poster and Oral. Presentation tools: Introduction to presentation tool, features and functions, creating presentation, customizing presentation, showing presentation.

MS-Word: Introduction to MS Word, Editing a Document Previewing Documents, Printing Documents, Formatting Documents. Find and Replace, Checking the Grammar and Spelling, Table Insert and Modification, Conversion of Table, Converting a Word document in various format.

MS-Power Point: Creating Presentation using Slide Master, Working with different Views and Menus of Power Point, Working with Slides, Editing and Formatting text, Bullets, Footer, Spell Checking, Printing Presentation, Inserting Objects, Slide Sorter, Slide Transition and animation effects.

Internet: Evolution, Growth of Internet, ISP, Dial-up, Connectivity with Internet, URL, Application, E-Mail Concept, Advantages of E-Mail, Address of E-mail, Basics of Sending and Receiving E-MAIL.

Reference Books:

1. Kothari, C.R. (2010), Research Methodology (Methods and Techniques), New Age International Publishers.
2. Saxena, S. (2010), A first course in Computers, Vikas Publishing house Pvt. Ltd.
3. Michael Devis, Ethics and the University, Routledge (1999).
4. Gurumani, N. (2010), Scientific Thesis Writing and Paper Presentation, MJP Publishers
5. Dahlberg, L. and McCaig, C. (2010), Practical Research and Evaluation, SAGE Publications India Pvt. Ltd.
6. Saxena V. P. Research Methodology: Indira publishing House, Bhopal.

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Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) **Semester:** II

SUBJECT: MATHEMATICS **PAPER: RESEARCH METHODOLOGY**

Session 2018-2019

TITLE: RESEARCH METHODOLOGY

SYLLABUS

Research Paper Preparation:
Preliminaries, Format, Choosing Journal, Study of General guidelines for authors, Title, Running Title, Authors: Single and Multi authorship, Writing Abstract, Introduction section, Formulation of problem, method of solution/Analytical proofs, Result Section, Figures; Design Principles, Legends, Table components, Graphs; Types, Style. Discussion Section: Format, Grammar Style, Content, Acknowledgements, References: Citation and styles of listing, Selecting Keywords, Submission of manuscript: Communication with the Editor, Handling Referees, Comments, Galley Proofs, Writing Review Articles,

Writing a Synopsis
Title and contents with page number, Introduction, Brief review of the previous work, Proposed Work, Work plan, Research Methodology, Expected outcomes, References.

Writing a Dissertation
Inside The Dissertation: First Inside Page, Inside Documents, Contents. Main Body Of The Dissertation: Introduction, The Other Chapters, References.

Research Projects:
Plan for an innovative project; plan for project proposal, compilation of proposal, selection of funding agency, submission of proposal, Report generation: significance, steps of report writing and its types.

Writing of thesis:
Format of a thesis; Review of literature, formulation; Writing methods, results; preparation of Tables, figures; writing discussion; writing conclusion; writing summary and synopsis; Reference citing and listing/Bibliography, Avoiding Plagiarism. Font And Font Size, Spacing, Margin, Page Numbering, Photomicrographs/Photographs/Drawings, Multi-Volumes, Assembling The Thesis.

Facing a Research Degree Meeting
The Title, Motivation, Detailed Introduction, Previous work, Note worthy contributions, Contribution of Supervisor, Contribution of candidate (if any), Methodology, Work plan, References

Presentation of Research Papers
Poster Presentation, Oral Presentation, Important Tips For Paper Presentation.

MATLAB:
Introduction to MATLAB, Basics of MATLAB: MATLAB windows, Input-output, File types, General commands. Script files, Function files, Plotting simple graph.

Reference Books:

1. Kothari, C.R. (2010), Research Methodology (Methods and Techniques), New Age International Publishers.
2. Saxena, S. (2010), A first course in Computers, Vikas Publishing house Pvt. Ltd.
3. Gurumani, N. (2010), Scientific Thesis Writing and Paper Presentation, MJP Publishers
4. Saxena V. P. Research Methodology: Indira publishing House, Bhopal.
5. Rudra Pratap, Getting Started With MATLAB, Oxford University Press, Indian Edition

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Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **II**

SUBJECT: MATHEMATICS **PAPER: Algebraic Topology & Spline Theory**

Session 2018-2019

TITLE: **Algebraic Topology & Spline Theory**

SYLLABUS

Section-A Spline Theory:-Interpolation, Polynomial Interpolation. The general problem of finite interpolation, system possessing the interpolation property, Unisolvence representation theorems, Lagrange formula, Newton Formula divided difference, its simple properties, osculatory interpolation. Limitation of polynomial approximation, Runge example, Lebesgue Function, Piecewise Linear Approximation: Broken Line interpolation, Broken Line interpolation is nearly optimal. Least squares approximation by Broken Line, Hat functions, Good meshes, square root example problem (excluding computer program).Piecewise cubic interpolation, cubic Hermite interpolation, cubic Bessel interpolation, Akima interpolation. Cubic Spline interpolation, Boundary condition. Best approximation properties of complete cubic Spline interpolation and its error.Truncated power function. Pythagoras theorem. Smoothest interpolation property. Best approximation property problems (excluding computer programs)

Section-B Algebraic Topology:-Path, Path connected spaces, Equivalent paths, The fundamental group, Isomorphism of fundamental groups, Homomorphism of fundamental groups. Induced homomorphism. The Hornotopy Groups.
Fundamental Group of circles. Covering spaces local homomorphism. G spaces properties of the covering spaces. Fibrations, Unique Path Lifting, Fibrations of equivalent paths. Geometric simplexes and complexes. Topological Dimension, Broawer Fixed point theorem. Barycentric Subdivision.

Recommended Boos:-

1. E. Deboor: A. Practical Guide to Splines, Springe, Verlag, New York 1978. Chapter-1 2 3 4 5.
2. B.K. Lehri: A first course in Algebraic Topology (Narosa Publishers)

Reference Books:

1. L.L. Schumaker: Spline Functions Basis Theory, John Wiley and Sons, New York, 1981.
2. James Munkers: Topology, Second Edition.

Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **II**

SUBJECT: MATHEMATICS **PAPER: Atomistic and Multiplicative Lattices**

Session 2018-2019

TITLE: **Atomistic and Multiplicative Lattices**

SYLLABUS

Lattices, modular lattices, distributive lattices, Boolen Algebra product of lattices. Symmetric Lattice and basic properties of lattices: Modularity in Lattices Semiorthogonality in lattices orthogonality in lattices in symmetric lattices, Distributivity and the centre of a lattice of complete lattices,perspectivity and projectivity in lattices.

Atomistic Lattices and the Covering Property: The Covering Property in Atomic Lattices, Atomistic Lattices with the covering property, Finite-Modular AC-Lattices, Distributivity and Perceptivity in Atomistic lattices, Perceptivity in AC Lattices, completion by cuts.

Multiplicative Lattices:Defination Principle, Quotients Lattices, Noetherian Lattices.

Recommended Books:

1. Theory of Symmetric Lattices, F.Maeda and S.Maeda, Springer Verlag,1970
2. Abstrol Theory by R.P. Dilwaorth Pacific Journal Vol.

Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **II**

SUBJECT: MATHEMATICS **PAPER: Generalized Integral Transformation**

Session 2018-2019

TITLE: Generalized Integral Transformation

SYLLABUS

Multinormed spaces, Countable-Union Spaces, Duals of Countably multinormed Spaces, Duals of countable-union Spaces, operators and Adjoint Operators, the Spaces D(I)
And their Duals; Distributions, the space E(T) and its dual;Distributions of compact, Supports, Generalized function.
The Testing-Function Spaces L(a,b) and L(w,z) and their DualThe two-sided Laplace Transformation ,Operation-transform Formulas, inversion and Uniqueness. An Operational Calculus , convolution, the Laplace Transformation of Convolution, the Cauchy problem for the Wave equation in One-Dimensional Space.
The testing function, spaces M(a, b) and M(w, z) and their duals, the Mellin transformation, operation transform formulae Operational Canculus for Euler differential equations.
The testing Function Spaces A, Genaralized Functions space A' Orthonormal series Expansions and Generalized integral transformations, Characterization of the Generalized junction in A' and their Transforms, an Operational Calculus for the operator R.

Recommended Books:

1. Basic Reading:-Zemanian A.H. : Generalized Integral Transformations, john-wiley & Sons (1968).
2. Pathak R.S,: Course in Distributions theory & applications, Narosa(2001).
3. Gwaiz MA., Theory of distributions, Marcel-Dekker(1992).
4. Kanwal R. P. , Generalized function; theory & techniques, Academic press(1983).
5. Keshavan s. , topics in functional Analysis & applications wliey Eastern.

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Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **II**

SUBJECT: MATHEMATICS **PAPER: Trellis Theory**

Session 2018-2019

TITLE: **Trellis Theory**

SYLLABUS

Pseudo –ordered Set ,Trellises , Complete trellises, Transitive and Associative elements ,Distributive Elements, Standard Elements, Modular Trellises Boolean Lattices , Mappings , Ideals , Trellis Groups

Recommended Books:

1. Skala H. L. , Trellis theory , American Mathematical Society, providence , R. I. 1972.
2. Gratzer G. : Lattice theory-first Concepts and Distributive Lattices.
3. Birkhoff G. : Lattice theory, (American Mathematical Society, providence, Rhose Island,(1967) Colloquium Publication,25.

Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **II**

SUBJECT: MATHEMATICS **PAPER: Fluid Dynamics**

Session 2018-2019

TITLE: **Fluid Dynamics**

SYLLABUS

INTRODUCTION AND PHYSICAL PROPERTIES OF FLUID: Concepts of fluid, types of fluid, continuum hypothesis, Physical properties of fluid: - Density, specific weight, specific volume, pressure, Viscosity and surface tension, Compressibility and Bulk modulus, vapour pressure and examples.

KINEMATICS OF FLUID : Basic concepts, Eulerian and Lagrangian methods for description fluid motion, steady and unsteady motion, stream line motion and turbulent motion, uniform and non-uniform motion, rotational and irrotational motion, stream line, path line, streak line, velocity potential, stream function, vorticity vector, equation of continuity, equation of continuity by Eulerian and Lagrangian methods, equation of continuity in different coordinates, Velocity and acceleration of fluid particle.

EQUATION OF MOTION: Euler's equation motion, pressure equation, Bernoulli's equation, Cauchy's integrals, equation for impulsive action example, Flows and circulation Kelvin's circulation theorem, Helmholtzs Vorticity equation.

Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **II**

SUBJECT: MATHEMATICS **PAPER:**

Session 2018-2019

TITLE: **Numerical Analysis**

SYLLABUS

Boundary value problems, shooting method, derivative Boundary condition, Characteristic value: Alternating Direction implicit method, irregular regions and nonrectangular grids .Finite difference approximations to partial derivatives, the local truncation error, consistency and Inconsistency of numerical method, convergence and analysis of approximations, stability, von Neumann analysis, the global rounding error.

Parabolic partial differential equations, solution techniques for Parabolic equation in one dimension, parabolic equations in Two and three dimensions, finite difference methods finite Element methods for parabolic partial differential equations.

Hyperbolic partial differential equations, solution techniques, Equations in two and three dimensions, finite element methods In hyperbolic partial differential equations.

Recommended Books:

1. Basic Reading: Gerald and Wheatley: Applied numerical Analysis, sixth edition , Pearson education 2002

Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil. (Mathematics) Semester: **II**

SUBJECT: MATHEMATICS **PAPER: Operations Research**

Session 2018-2019

TITLE: **Operations Research**

Syllabus

Games and Strategies : Introduction, two person Zero-sum games, the maximin minimax principle, Games without saddle points-mixed strategies, graphic solution of 2xn and mx2 games, Dominance property, general solution of mxn Rectangular games.

Dynamic Programming : Introduction, the Recursive equation approach, characteristics of Dynamic programming, Dynamic programming algorithm, solution of L.P.P. by Dynamic programming .

MARKOV Analysis: Introduction, Markov processes, State Transition matrix, Transition diagram, Construction of a State-Transition Matrix, nstep Transition Probabilities Markov analysis algorithm.

Non-Linear Programming : Introduction formulating a NLPP, General NLPP, Constrained optimization with equality constraints, constrained optimization with inequality constraints, saddle point probles, saddle points and NLPP.

NLPP methods : Introduction, Kub-Tucker conditions with non-negative constraints, Quadratic programming, Wolfe smoldifled simplex method, Beade's method, separable convex programming, separable programming algorithm.

Network Scheduling by PERT/CPM : Introduction,Network and basic components, logical sequencing rules of network construction critical path analysis, probability considerations in PERT, Distinction between PERT and CPM.

Simulation : Introduction, why simulation methodology of simulation, simulation models, Event type simulation, generation of random numbers, Monte-Carlo simulation, simulation of maintenance problems, simulation of networks, advantage and limitations of simulation.

Recommended book:-

1. Kanti Swaroop, P.K. Gupta and Man Mohan, Operations Research, Eleventh Edition (S.Chand publications),
2. H.A. Taha, Operations Research-An Introduction PHI.

References:-

1. A. Ravindran, D.T. Phillips, J.J. Solberg, "Operations Research: Principles and Practice", second edition, John Wiley and sons (Asia), New Delhi 2006.
2. S.S. Rao, Engineering Optimization, Third Edition, New Age International (P) Ltd. New Delhi 1996.

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Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **II**

SUBJECT: MATHEMATICS **PAPER: Mathematical Modeling**

Session 2018-2019

TITLE: **Mathematical Modeling**

SYLLABUS

Application of first order differential equations
1.1 Growth and decay
1.2 Dynamics of Tumour growth
1.3 Biological Growth
1.4 A problem in Epidemiology
Setting up first-order differential equations from word problems
Difference and Differential equation population growth models
Single species population models
A model for detection of diabetes
Combat models
5.1 Three Lanchester Combat Models
5.2 Conventional Combat: The square law
5.3 Guerrilla Combat: The linear law.

Recommended Books:-

1. Mathematical Modeling : J.N. Kapoor, New Age International (P) Limited , Publishers, Reprint 2003,
2. Differential Equations and their Applications: Zafar Ahsan, Second Edition , Prentice-Hill of India, New Delhi – 110001,
3. Differential equation Models : Martin Braun, Courteny S Coleman Donald A Drew, Vol.1 Springer – Verlag.

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Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **III**

SUBJECT: MATHEMATICS **PAPER: Commutative Algebra**

Session 2018-2019

TITLE: **Commutative Algebra**

SYLLABUS

Minimal prime and primary ideals: Examples and properties of minimal, prime and primary ideals. The nil radical of an ideal and its properties, semi prime ideals. The associate prime ideal of a primary ideal.

Minimal prime ideals of a ring, Certain radicals of a ring : Jacobson Radical, the definition of the idempotent of Rh can be raised or lifted into R and its properties, primary rings.

Quasi-regular element and its properties, prime radicals, modular ideals, radical of a ring, Boolean rings, regular rings, Stone representation theorem, direct sum of rings, problems.

Birkhoff theorem, rings with chain conditions : Equivalence of three conditions of a ring with a.c.c. , Hilbert basis theorem, Levitsty Theorem.

Recommended Books :

1. Barton David M.: A first course in rings and ideals Addison Wesley publishing company 1970.
2. Oscar Zoriskiand P. Samuel : Commutative algebra, Vol. 1, Affiliated East press Pvt. Ltd. Delhi.

References :

1. M. Atiyah and IC. McDonald: Commutative algebra.
2. Motsumura : Commutative algebra.

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Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **III**

SUBJECT: MATHEMATICS **PAPER: Theory of Fuzzy Computation**

Session 2018-2019

TITLE: **Theory of Fuzzy Computation**

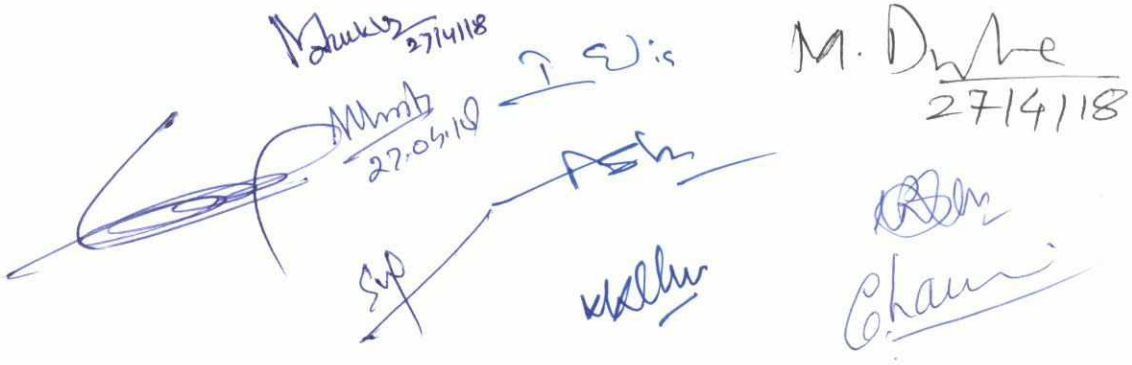
SYLLABUS

Max-mm automata, General formulation of automata, Classes of automata, Behaviour of Max-mm automata, Equivalence and homomorphism of max-mm automata.

Reduction of max-mm automata, definite max-mm automata, Reduction of max-mm machines, Equivalences, Irreducibility and minimality, Determinism and non-determinism of max-mm automata.

Max-product machines, equivalences, irreducibility and minimality, Max-product grammars and languages, weak regular max-product grammars and languages.

Fuzzy languages, types of grammars, Fuzzy context-free grammars, Context-free max-product grammars, Context-free fuzzy languages, Meaning of context free languages.



Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil. (Mathematics) Semester: **III**

SUBJECT: MATHEMATICS **PAPER: Theory of Near Ring**

Session 2018-2019

TITLE: **Theory of Near Ring**

SYLLABUS

Definition and properties of N-groups and substructures Homomorphism and Ideals. Annihilators. Near Ring of quotients. Products. Embedding in M(r).
Chain condition. Prime ideals, Semi-prime ideals, Nil and Nilpotent ideals. Idempotent elements.
Distributively generated Near Rings. Construction of distributively generated near Rings. Distributively generated Near Rings with finiteness conditions. Polynomial Near Rings.
Near fields. Condition to be a field. The additive group of a Near field. The centre and kernel of a Near field. Dikson Near fields.

Recommended Books:

1. Guntur Pilz: Near Rings, North Holland Publishing Company, Revised Edition 1983.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Phil.(Mathematics) Semester: **III**

SUBJECT: MATHEMATICS **PAPER: Theory of Choice**

Session 2018-2019

TITLE: **Theory of Choice**

SYLLABUS

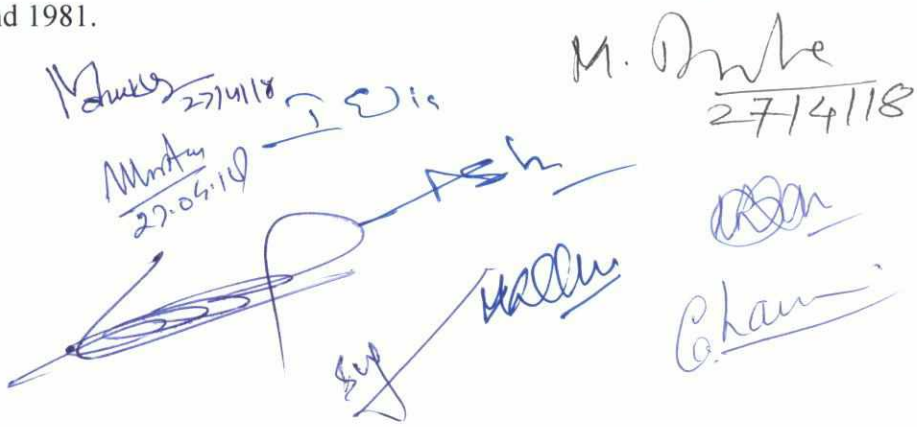
Preliminaries: The concept of choice, Examples of choice problems in economics. Ordering relation, Mapping and Correspondences, Maximal elements and greatest elements, Utility functions, The axioms of preference model Revealed Preference, Favorability and revealed favorability, The logical significance of the preference model.

A choice Function model, The connection between the choice function model and the preference model, some implications of the choice function model.

Introduction, sets in real Euclidean space, C.U.P. sets, Theorem on C.U.P. sets, Properties of real valued functions. The axioms of the consumer preference model, the utility function, the demand function and its connection with choice function , preference sets, Duality in consumer choice theory, Preordering of the price space and the dual utility function, Demand functions, price functions and revealed preference relations.

Recommended Books:

1. Basic Reading: Axiomatic choice Models, H.N. Weddepohl, Rotterdam University Press, Netherlands 1970.
2. Social Choice and Individual values Edn.2, Arrow K.J., John Willey and Son's, New York-1963
3. Handbook of Mathematical Economics-Vol.1, Arrow K.J. and Intriligator Amsterdam, north-Holland 1981.



Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) Semester: **III**

SUBJECT: MATHEMATICS PAPER: Topics in Geometric Function Theory

Session 2018-2019

TITLE: Topics in Geometric Function Theory

SYLLABUS

Schwarz's Lemma, Montel's Theorem, Green's Theorem on Harmonic functions, Univalent functions, Keobe Functions, Area theorem, Growth and distortion theorems.

Brief History of D'Branges Theorem, Littlewoods's Theorem, Convex, Starlike Function, Alexander's Theorem. Close to convex functions, Noshiro-Warchawski,s Theorem, Kaplan's Theorem.

Spiraflike functions, Radius of starlikeness, convexity and close to convexity, Differential subordination, Hypergeometric functions Rusheweyh derivative operator, convolution (Hadamard product)

Extreme points, Herglotz representation, meromorphic univalent functions, harmonic univalent functions, Fractional derivatives, coefficient inequalities, closure property.

Recommended Books:

1. P.L Duren: Univalent Functions, Springer-Verlag, New York, Berlin, Heidelberg. 1983.
2. S.S Miller and P.T Mokano: Differential Subordinations, Mercel Dekkar, Inc., New York, Basel, Hong –Kong.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Phil.(Mathematics) Semester: **III**

SUBJECT: MATHEMATICS **PAPER: Fuzzy Measures and Integrals**

Session 2018-2019

TITLE: **Fuzzy Measures and Integrals**

SYLLABUS

In this course student will be acquainted with concepts of Fuzzy relation, fuzzy Logic, Fuzzy Measures and Fuzzy Integrals.

FUZZY RELATION:

Projections and cylindrical:1 Extensions, Binary Fuzzy Relations on single set, Fuzzy equivalence relations, Fuzzy compatibility Relations, Fuzzy ordering Relations, Fuzzy morphisms SUP-i compositions and INF- wi compositions. Fuzzy Relation Equations: Problem Partitioning, solutions, methods, Fuzzy Relation Equation based on sup-I and INF-wi compositions, Approximate solutions.

FUZZY LOGIC:

Fuzzy Propositions, Fuzzy Quantifiers, Linguistic Hedges, Inference from conditional fuzzy propositions, Qualified and quantified propositions. Approximate Reasoning: Fuzzy expert system, Fuzzy implications, selection of Fuzzy implications, Multi conditional Approximate Reasoning , Role of fuzzy relational equations ,Interval valued Approximate Reasoning.

FUZZY MEASURES:

Fuzzy measures, Evidence theory, possibility theory, Fuzzy sets and possibility theory, possibility theory verses probability theory. Uncertainty based Information and Uncertainty, Non specificity, of crisp sets and fuzzy sets fuzziness of fuzzy sets, uncertainty in Evidence theory, summary of uncertainty measures, principles of uncertainty.

Fuzzy measures as non additive measures, Sugeno integrals and its properties, Choquet integral, Fuzzy integrals as an aggregation operators. Applications to multi criteria Decision making Choquet integral in multi-attribute decision making.

Recommended Books:

1. George J Klir, Bp yuan , fuzzy sests and fuzzy Logic. Theory and applications, Prentice-Hall of India . Pvt . Ltd (2000)
2. M. Grabish , Sugeno, and Murofushi Fuzzy Measure and Integrals. Theory and Applications PHL , 1999, India.
3. H.J Zimmeremann, fuzzyset Theory and its Applications Kiuwer, 1984.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Phil.(Mathematics) Semester: **III**

SUBJECT: MATHEMATICS PAPER: Game theory with Economic Application

Session 2018-2019

TITLE: Game theory with Economic Application

SYLLABUS

Static Game with Complete information: Nash Equilibrium. Oligopoly Strategies Trade policy, Property rights and efficiency, Voting games.

Dynamic Games with complete information: Sub game perfect equilibrium, Bargaining time-consistent macroeconomics policy, repeated games and dynamic competition.

Static games with incomplete information: Perfect Bayesian Nash equilibrium, Auctions.

Dynamic Games with incomplete information: Perfect Bayesian equilibrium, Bargaining with private information.

RECOMMENDED BOOKS:-

1. H. Scott Bierman and Luis Fernandez, Game Theory with economics Applications, Peason Eduaction second edition.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Phil.(Mathematics) Semester: **III**

SUBJECT: MATHEMATICS **PAPER: Graph Theory and its Applications**

Session 2018-2019

TITLE: **Graph Theory and its Applications**

SYLLABUS

Trees: Properties of trees, Distance and centres in a tree. Rooted, Binary, counting and Spanning trees, Fundamental circuits, Finding all spanning trees of a graph, spanning trees in a weighted graph.

Cut-sets: Properties of a cut-sest, fundamental cut-sets, connectivity and separability, network flows , 1. Isomorphism.{Chapter-3 and 4 of (1)}

Planar Graphs: Kuratowski's two graphs , Different representations of a planar graph , Detection of planarity , Geometric dual , Combinatorial dual.{Art. 5.2to 5.7 ofChapter5of (1)}

Matrix representation of graph : Incidence matrix, sub matrices of A(G), Circuit Matrix, Fundamental Circuit Matrix and Rank of B, Application to a switching network, Cut-set Matrix , Relationship among Af, Bf, Cf path matrix , adjacency matrix. {Chapter 7of (1)}

Colouring, covering and partitioning: Chromatic number, partitioning, polynomial, Matching's, coverings, the four colour problem.

Directed Graphs: Types of digraphs, Diagraphs and binary relations, Directed paths and connectedness , Euler diagraphs , Trees with directed edges, Fundamental circuits in digraphs, Matrices A, B and C of Digraphs , Adjacency matrix of a diagraph, Tournaments Acyclic diagraph and Decyclization.{Chapter 9 of(1)}

Enumeration: Types of enumeration, counting labelled and unlabelled trees. Polya's Counting Theorem.{Art.10.1 to 10.4 of Chapter 10 of (1)}

Graph in switching and coding theory.

RECOMMENDED BOOKS:-

1. "Graph Theory; with applications to engineering and computer science" by Narsingh Deo.
2. Graph Theory; By Hararay.
3. Design theory by C.C Lindner, C.A Rodger , CRC Press New York 1997.
4. Diagraphs: Theory, Algorithms and application Second edition springer verlog London 2009.
5. Graphs and diagraphs by G. Chart and L. Leshiak Chapman and Hall CRC. NEW York 1996.

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Phil.(Mathematics) Semester: **III**

SUBJECT: MATHEMATICS **PAPER :Topics in General Relativity**

Session 2018-2019

TITLE: Topics in General Relativity

SYLLABUS

Killing vector field, Isometry. Necessary and sufficient conditions for isometry. Homogeneity and isometry. Maximally symmetric space-time. Einstein space. The action principle, the energy momentum tensor. The stress energy momentum tensor for perfect fluid, electromagnetic field. Einstein's field equations from action principle and its Newtonian approximation flat space and empty space. Local conservation laws associated with perfect fluid distribution.

Schwarzschild space-t me. Spherical symmetry. Einstein field equations under spherical symmetry. Schwarzschild exterior solution. Isotropic Co-ordinates, Retarded time. Isotropic form of Schwarzsehild exterior solution. Tetrad formalism, Covariant Differentiation, Ricci's rotation coefficients, Cartan's equations of Structure, Bianchi identities, Lie derivative, Calculation of connection 1- forms and curvature 2- forms for Vaidya's metric, Godel metric and spherically symmetric space times. '

Geometry of the expanding universe, space of constant curvature, space of negative curvature, Einstein Universe, De sitter Universe, A non isotropic model. Properties of Einstein and De Sitter Universe, The linearized field equation. The weyl solution to linearized field equations. Associated Weyl solutions.

Recommended Books:

1. Basic Reading: Fuzzy Automata aid languages: Theory and Applications, J.N. Mordeson and D.S. Malik, Champan and Hall/ CRS Press. New York 2002
2. Fuzzy Relational Calculus: Theory Application and Software, Ketty P. and Yordan k., World Scientific. New Jersey, 2004.
3. Introduction to Automata Theory, Languages and Computation, Hopcroft J.E. and Uliman J.D. , Narosa Publishing House, New Delhi 1993.

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Phil.(Mathematics) Semester: **III**

SUBJECT: MATHEMATICS PAPER: Group Analysis of Differential Equations

Session 2018-2019

TITLE: **Group Analysis of Differential Equations**

SYLLABUS

One Parameter Transformation groups, local lie group, tangent vector field, Lie Equation. Examples, correspondence of groups and vector fields, criterion of invariance, examples of invariants.

Groups admitted by differential equations, Fundamental definitions, Action on solutions, full group, Lie algebra of operators, commentators, action of mappings. Algebraic properties, structural tensor, isomorphism criterion.

Full Lie group of concrete system of equations, system of first order equations, general solution analysis, structure of full Lie algebra, Higher order equation.

Structural constants, homomorphism, sub algebras, factor algebra, the redical , Levi theorem (Statement only) , Associated Lie algebra, algebra of differentiation, inner automorphism, Killing's form, Structural properties, Optimal sub algebraic systems, Maltsev-Harish-Chandra Theorem (statement only), examples.

Recommended Books:

1. Basic Reading: L.V. osiannikov, Group analysis of differential equations Academic press 1982.
2. G.W. Bluman and J.D. cole, similarity methods for differential equations, springer verlag NY 1974.

Institute for Excellence in Higher Education (IEHE), Bhopal

M. Phil.(Mathematics) **Semester:**III

SUBJECT: MATHEMATICS **PAPER: H-Function of One and Two Variables**

Session 2018-2019

TITLE: **H-Function of One and Two Variables**

SYLLABUS

The H Functions of one variable. Definition. Asymptotic expansion, Simple transformation and elementary properties.

Mellin and Laplace transforms. Special cases, Differentiation formulas of H-Function one Variable, Integration of H-function of one Variable.

The H-Functions of two variables, Definition and notation. Asymptotic behavior elementary properties special cases.

Derivatives. Contiguous relations. Finite Summation formulas for the H-Functions of two variables.

Books Recommended:

- Shrivastava. H. M., Gupta K. C. and Goyal. S. P.: The H- Functions of One and Two Variables with applications. South Asian Publication New Delhi.