

**DEPARTMENT OF MATHEMATICS**  
**COURSE CURRICULUM & MARKING SCHEME**

**B.Sc. Part - III**  
**MATHEMATICS**

**SESSION : 2023-24**



**ESTD : 1958**

**GOVT. V.Y.T. PG AUTONOMOUS COLLEGE,  
DURG, 491001 (C.G.)**

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A<sup>+</sup>, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

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**DEPARTMENT OF MATHEMATICS**  
**GOVT. V.Y. T. PG. AUTONOMOUS COLLEGE, DURG**  
**SYLLABUS**  
**for**  
**B.Sc. Part-III**

The syllabus with the paper combinations and Marking Scheme for Session 2023-24.

Paper No.	Title of the Paper	Marks Allotted in Theory	
		Max	Min
I	Analysis	50	
II	Abstract Algebra	50	
III	Optional Paper (A) Discrete Mathematics (B) Application of Mathematics In Finance and Insurance (C) Mathematical Modelling (D) Computational Mathematics Laboratory	50	
	<b>Total</b>	<b>150</b>	<b>50</b>

**Total Marks - 150**

The syllabus for **B.Sc. Part-III** is hereby approved by the members of Board of Studies for the session 2023-24.

In case, any change or modification is prescribed by Central Board of Studies or Higher Education Deptt., Govt. of Chhattisgarh with respect to content or distribution of marks for Undergraduate syllabi, it will be implemented accordingly.

**Name & Signature**

**Chairperson / H.O.D** - Dr. Padmavati

Subject Expert - Dr. Madhu Srivastava

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

**Representative Members -**

(1) Dr. Anil Kashyap -

(2) Shri A. K. Pandey -

(3) Dr. Mayur Puri Goswami -

**Faculty members** Dr. M.A. Siddiqui

Dr. Rakesh Tiwari

Dr. (Smt.) Prachi Singh

Ambalika Chauhan -

Chitra Kumar -

Gayatri Yadav -

Bijma Kumari -

**B.Sc. Part – III (MATHEMATICS)****2023-2024****PAPER-I****ANALYSIS****Max. Marks. 50**

Course Title	E. Sc. Part – III. Analysis
CO No.	<b>Course Outcomes - This course will enable the student to :</b>
CO No. – 1	Understand Series and their convergence, various test of convergent, Implicit function, Fourier series etc.
CO No. – 2	Apply Reimman integration, mean value theorem, Integral as a function of parameter etc.
CO No.- 3	Remember complex number, complex valued function, Analytic function, Conformal mapping etc.
CO No.- 4	Understand Metric spaces, Contraction principle, Complete metric space, various types of spaces.

**METRIC SPACES:**

**UNIT-I** Construction of real numbers as the completion of the incomplete metric space of rationals. Real numbers as a complete ordered field. Definition and examples of metric spaces. Neighborhoods. Limit points. Interior points. Open and closed sets. Closure and interior. Boundary points. Sub- Space of a metric space. Cauchy sequences. Completeness. Cantor's intersection theorem. Contraction principle.

**UNIT-II** Dense subsets. Baire Category theorem. Separable space, second countable and first countable spaces. Continuous functions. Extension theorem. Uniform continuity. Isometric and homeomorphism. Equivalent metrics. Compactness, Sequential compactness. Totally bounded spaces. Finite intersection property. Continuous functions and compact sets. Connectedness. Components. Continuous functions and connected sets.

**COMPLEX ANALYSIS:**

**UNIT-III** Complex numbers as ordered pair. Geometric representation of Complex numbers. Stereographic projection. Continuity and differentiability of complex functions. Analytic functions. Cauchy-Riemann equations. Harmonic functions. Elementary functions. Mapping by elementary functions. Mobius transformations. Fixed point. Cross ratio. Inverse points and critical mappings. Conformal mappings.

**REAL ANALYSIS:**

**UNIT-IV** Riemann integral. Integrability of continuous and monotonic functions. The fundamental Theorem of integral calculus. Mean value theorems of integral calculus. Improper integrals and their

M. P. Singh, T. Khan, T. Rami, P. L. 17/13/23, R. K. Singh, R. K. Singh, P. K. Singh, P. K. Singh, P. K. Singh, P. K. Singh

convergence, comparison tests, Abel's and Dirichlet's tests. Frullani's integral. Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter.

**UNIT-V** Series of arbitrary terms. Convergence, divergence and oscillation. Abel's and Dirichlet's test. Multiplication of series. Double series. Partial derivation and differentiability of real valued functions of two variables. Schwarz and Youngs theorem. Implicit function theorem. Fourier series. Fourier expansion of piece wise monotonic function.

### REFERENCES:

1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New-Delhi,1985.
2. R.R. Goldberg, Real Analysis, Oxford & IBH Publishing Company New-Delhi,1970.
3. S. Lang, Undergraduate Analysis, Springer-Verlag, New-York ,1983
4. D.Somasunderam and B. Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi,1997.
5. Shanti Narayan, A Course of Mathematical Analysis, S. Chand & Company New-Delhi.
6. P.K. Jain and S.K. Kaushik, An Introduction to Real Analysis , S. Chand & Company New-Delhi ,2000.
7. R.V. Churchill & J.W. Brown, Complex Variables and Applications , 5<sup>th</sup> Edition, Mc-Graw Hill,New-York ,1990.
8. Mark J. Ablowitz & A.S. Focas, Complex Variables : Introduction and Applications, Cambridge University Press South Asian Edition, 1998.
9. Shanti Narayan, Theory and Functions of a Complex Variable, S. Chand & Company New-Delhi. E.T. Copson. Metric Spaces Cambridge University Press , 1968.

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(4) Dr. Anil Kashyap -

(5) Shri A. K. Pandey -

(6) Dr. Mayur Puri Goswami -

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eigenvectors of a linear transformation. Diagonalisation, Annihilators of a subspace. Bilinear, Quadratic and Hermilton forms.

**UNIT-V** Inner product spaces - Cauchy-Schwarz inequality. Orthogonal vectors. Orthogonal complements. Orthogonal normal sets and basis. Bessel's inequality and for finite dimensional spaces. Gram-Schmidt orthogonalization process.

### REFERENCES:

1. I.N.Herstien, Topics in Algebra, Wiley Eastern Ltd. New-Delhi.
2. N. Jacobson, Basic Algebra Vols. I & II ,W.H. Freeman, 1980.
3. Shanti Narayan, A Text book of Modern Abstract Algebra, S. Chand & Company New-Delhi.
4. K.B. Dutta, Matrix and Linear Algebra ,Prentice Hall of India Pvt. Ltd. New-Delhi 2000.
5. P.B.Bhattacharya,S.K.Jain and S.R.Nagpal,Basic Abstract ( 2<sup>nd</sup> edition ) Cambridge Univercity Press,Indian edition,1997.
6. K.Hoffman and R.Kunze,LinearAlgebra 2<sup>nd</sup> Edition,Prentice Hall Englewood Cliffs,New Jersey.1997.
7. S.K.Jain,A Gunawardena & P.B.Bhattacharya,Basic Linear Algebra with MATLAB.Key college publishing ( Springer Verlag) 2001
8. S. Kumaresan,Linear Algebra,A Geometric Approach, Prentice-Hall of India,2000.
9. Vivek Sahai and vivkas bist, Algebra Norosa Publishing House, 1997.
10. I.S. Luther and B.S:Passi, Algebra Vol. 1-Groups,Vol. II-Rings.Norosa Publishing House ( Vol.1-1996,Vol.II-1999)
11. D.S. Malik , J.N.Mordeson and M.K.Sen Fundamentals of Abstract Algebra,McGraw Hill International Edition, 1997.

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**B.Sc. Part – III (MATHEMATICS)****2023-2024****Paper III****Discrete Mathematics****Max.Marks.50**

Course Title	B. Sc. Part – III, Discrete Mathematics
CO No.	<b>Course Outcomes - This course will enable the student to :</b>
CO No. - 1	Understand of discrete graphs, connected and strongly connected graphs etc.
CO No. - 2	Analyze various graphs in which Eulerian and Hamiltonian graph with special importance.
CO No.- 3	Apply finite state machine and their application, Boolean algebra in switching circuits.
CO No.- 4	Remember discrete numeric function its use in recurrence relation and generaticfuction.

**UNIT -I** Sets and proposition - cardinality. Mathematical induction. Principle of inclusion and exclusion. Computability and formal languages - Ordered sets. Languages, Phrase structure grammars. Types of grammars and languages. Permutations, Combinations and Discrete probability.

**UNIT -II** Relations and Functions - Binary relations, Equivalence relations and partitions. Partial order relation and lattices. Chains and anti chains. Pigeon hole principle. Graphs and planar graphs - Basic terminology, Multi graphs, Weighed graphs, Paths and circuits, Shortest paths, Eulerian paths and circuits. Travelling salesman problem, Planar graphs: Trees.

**UNIT –III** Finite state machines - Equivalent machines. Finite state machines as language recognizers. Analysis of algorithms - Time complexity. Complexity of problems. Discrete numeric functions and Generating functions.














**UNIT – IV** Recurrence relations and Recursive algorithms – Linear recurrence relations with constant coefficients. Homogeneous solutions. Particular solution. Total solution. Solution by the method of generating functions. Brief review of Groups and Rings.

**UNIT-V** Boolean algebras - Lattice and Algebraic structures. Duality. Distributive and Complemented Lattices. Boolean lattices and Boolean algebras. Boolean functions and Expressions. Propositional calculus. Design and implementation of Digital Networks. Switching circuits

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**REFERENCES:**

- (1) C.L.Liu, Elements of Discrete Mathematics. [ Second Edition], McGraw Hill, International edition, Computer Science series,1986.

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**REFERENCES:**

1. Aswath Damodaran, Corporate Finance – Theory and Practice, John Wiley & Son's Inc.
2. John C. Hull, Options, Futures and Other Derivatives, Prentice Hall of Indian Private Ltd.
3. Sheldon M. Ross, An Introduction to Mathematical Finance, Cambridge University Press.
4. Mark S. Dorfman, Introduction to Risk Management and Insurance, Prentice Hall, Englewood Cliffs, New Jersey.
5. C.D.Daykin, T. Pentikainen and M. Pesonen, Practical Risk Theory for Actuaries, Chapman & Hall.

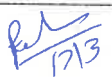








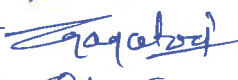


<p><b>Chairperson / H.O.D</b> - Dr. Padmavati <i>Padmavati</i>  <i>17/13</i></p> <p>Subject Expert - Dr. Madhu Srivastava <i>msr</i></p> <p>Subject Expert - Dr. Shabnam Khan <i>SK</i></p> <p>Subject Expert - Dr. S. K. Bhatt <i>SKB</i></p> <p><b>Representative Members -</b></p> <p>(1) Dr. Anil Kashyap - <i>AK</i></p> <p>(2) Shri A. K. Pandey - <i>AKP</i></p> <p>(3) Dr. Mayur Puri Goswami - <i>MPG</i></p>	<p><b>Faculty members -</b></p> <p>Dr. M.A. Siddiqui</p> <p>Dr. Rakesh Tiwari <i>RT</i></p> <p>Dr. (Smt.) Prachi Singh <i>PS</i></p> <p>Ambalika chauhan - <i>AC</i></p> <p>Chitra Kumar - <i>CK</i></p> <p>Gayatri Yadav <i>GY</i></p> <p>Bijma Kumari - <i>BK</i></p>
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**B.Sc. Part III (MATHEMATICS)****2023-2024****Paper III (Optional)****MATHEMATICAL MODELLING****Max.Marks.50**

- UNIT-I** The process of applied mathematics. Setting up first order differential equations—Qualitative solution sketching, Difference and differential equation growth models.
- UNIT-II** Single-species Population Models, Population growth-An age structure model, The spread of Technological Innovation.
- UNIT-III** Higher order Linear Models- A model for the detection of Diabetes, Combat modes, Traffic Models –Car-following models, Equilibrium speed distributions.
- UNIT-IV** Nonlinear Population growth models, Prey-Predator models, Epidemic growth models, Models from political science – Proportional representation-cumulative voting, comparison voting.
- UNIT-V** Applications in Ecological and Environmental subject Areas- Urban waste water management planning

**REFERENCES:**

1. Differential Equation Models, Eds. Martin Braun, C.S. Coleman, D.A. Drew.
2. Political and Related Models, Steven J. Brams, W.F. Lucas, P.D. Straffin (Eds.)
3. Discrete and System models, W.F. Lucas, F.S. Roberts, R.M. Thrall.
4. Life Science Models, H.M. Roberts & M. Thompson.
5. All volumes published as modules in Applied Mathematics, Springer-Verlag, 1982.
6. Mathematical Modeling, J.N. Kapur, New Age International, New Delhi.

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**B.Sc. Part – III (MATHEMATICS)****2023-2024****Paper III (Optional)****Computational Mathematics Laboratory****Max.Marks.50**

The student expected to familiarize himself / herself with popular software for numerical computation and optimization. Real life problems requiring knowledge of numerical algorithms for linear and nonlinear algebraic equations, Eigen value problems, Finite difference methods, Interpolation, Differentiation, Integrations, Ordinary differential equations etc. should be attempted. Capabilities to deal with linear, integer and nonlinear optimization problems need to be developed. The objective of such a laboratory is to equip students to model and simulate large-scale systems using optimization modeling languages. (The concerned teacher is expected to provide the necessary theoretical background before the student does the corresponding practical). To this end software like MATLAB, LINDO, MATHEMATICA, MAPLE can be adopted. Following course outline is suggested based on MATLAB and LINDO.

**UNIT 1:** Plotting of functions, Matrix operations, vector and matrix manipulations, matrix function, Data analysis and curve fitting.

**UNIT 2:** Use of FFT algorithms, Numerical integrations.

**UNIT 3:** Nonlinear equations and optimization functions, Differential equations.

**UNIT 4:** 2-D Graphics and 3-D Graphics – general purpose graphics functions, color maps and color controls, Examples: Number theory, picture of an FFT, Function of a complex variable, chaotic motion in 3-D.

**UNIT 5:** Sparse matrices – iterative methods for sparse linear equations, Eigen values of sparse matrices, Game of life, Linear programming, integer programming and Quadratic programming – modeling and simulation techniques.

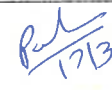












**REFERENCES:**

1. MATLAB – High performance numeric computation visualization software: Users guide.

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2. MATHEMATICA – Stephen Wilfram, Cambridge.
3. Introduction to operations research, F. S. Hiller and G. J. Lieberman.
4. Optimization modeling with LINDO: Linus Schrage.

<p><b>Chairperson / H.O.D</b> - Dr. Padmavati </p> <p>Subject Expert - Dr. Madhu Srivastava </p> <p>Subject Expert - Dr. Shabnam Khan </p> <p>Subject Expert - Dr. S. K. Bhatt </p> <p><b>Representative Members -</b></p> <p>(1) Dr. Anil Kashyap - </p> <p>(2) Shri A. K. Pandey - </p> <p>(3) Dr. Mayur Puri Goswami - </p>	<p><b>Faculty members -</b></p> <p>Dr. M.A. Siddiqui</p> <p>Dr. Rakesh Tiwari </p> <p>Dr. (Smt.) Prachi Singh </p> <p>Ambalika chauhan - </p> <p>Chitra Kumar - </p> <p>Gayatri Yadav - </p> <p>Bijma Kumari - </p>
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