

**GOVERNMENT AUTONOMOUS COLLEGE, RAJAMAHENDRAVARAM**

**M.Sc Mathematics Degree Examinations**

**Semester: II**

**Syllabus{w.e.f 2020-2021 Admitted Batch}**

**Paper - M 201: ALGEBRA – II**

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**UNIT - I**

Algebraic extensions of fields: Irreducible polynomials and Eisenstein criterion- Adjunction of roots- Algebraic extensions-Algebraically closed fields. (Sections 1 to 4 of Chapter 15)

**UNIT - II**

Normal and separable extensions: Splitting fields- Normal extensions- Multiple roots- Finite fields- Separable extensions (Sections 1 to 5 of Chapter 16)

**UNIT - III**

Galois theory: Automorphism groups and fixed fields- Fundamental theorem of Galois theory  
Fundamental theorem of Algebra (Sections 1 to 3 of Chapter 17)

**UNIT - IV**

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials- Cyclic extensions- Polynomials solvable by radicals - Ruler and Compass constructions. (Sections 1 to 3 and 5 of Chapter 18)

**Additional Module: (No question is given from this module)**

Noetherian and artinian modules and rings – Wedderburn- Artin theorem – Uniform modules, primary modules and Noether- Lasker theorem.

**TEXT BOOK:** Basic Abstract Algebra, Second Edition by P.B. Bhattacharya, S.K. Jain and S.R. Nagpani

**REFERENCE:** Topics in Algebra By I. N. Herstein.

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**M.Sc Mathematics Degree Examinations**

**Semester: II**

**Syllabus{w.e.f 2020-2021 Admitted Batch}**

**Paper: M 202 - Real Analysis-II**

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**UNIT-I**

Riemann-Stieltjes Integral: Definition and existence of the Riemann Stieltjes Integral, Properties of the Integral, Integration and Differentiation, the fundamental theorem of calculus – Integral of Vector- valued Functions, Rectifiable curves.

**UNIT-II**

Sequences and Series of the Functions: Discussion on the Main Problem, Uniform Convergence, Uniform Convergence and Continuity, Uniform Convergence and Integration, Uniform Convergence and Differentiation, Equicontinuous families of Functions, the StoneWeierstrass Theorem.

**UNIT-III**

Power Series: (A section in Chapter 8 of the text book)

Functions of Several Variables: Linear Transformations, Differentiation, The Contraction Principle, The Inverse Function theorem.

**UNIT-IV**

Functions of several variables Continued: The Implicit Function theorem, The Rank theorem, Determinates, Derivatives of Higher Order, Differentiation of Integrals.

**Additional Module: (No question is given from this module)**

Lebesgue theory – Set functions – Construction of the Lebesgue measure – Measure spaces – Measurable functions.

**TEXT BOOK:** Principles of Mathematical Analysis by Walter Rudin, International Student Edition, 3<sup>rd</sup> Edition, 1985.

**REFERENCE:** Mathematical Analysis by Tom M. Apostol, Narosa Publishing House, 2<sup>nd</sup> Edition, 1985.

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**M.Sc Mathematics Degree Examinations**

**Semester: II**

**Syllabus{w.e.f 2020-2021 Admitted Batch}**

**Paper: M 203 - COMPLEX ANALYSIS**

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**UNIT-I**

Elementary properties and examples of analytic functions: Power series- Analytic functions  
Analytic functions as mappings, Mobius transformations.

**UNIT-II**

Complex Integration: Riemann- Stieltjes integrals- Power series representation of analytic  
functions- zeros of an analytic functions - The index of a closed curve.

**UNIT-III**

Cauchy's theorem and integral formula - the homotopic version of Cauchy's theorem and  
simple connectivity- Counting zeros - the open mapping theorem.

**UNIT-IV**

Singularities: Classifications of singularities - Residues - The argument principle.

**Additional Module: (No question is given from this module)**

The Maximum modulus theorem- The maximum principle – Schwarz's lemma- Convex  
functions – Hadamard's three circles theorem – Phragmen Lindelof theorem.

**TEXT BOOK:** Functions of one complex variables by J.B.Conway 2<sup>nd</sup> edition, Springer  
International student Edition, Narosa Publishing House, New Delhi.

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**M.Sc Mathematics Degree Examinations**

**Semester: II**

**Syllabus{w.e.f 2020-2021 Admitted Batch}**

**Paper: M 204 - LINEAR ALGEBRA**

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**UNIT-I**

Elementary Canonical Forms : Introduction – Characteristic Values – Annihilating Polynomials –invariant subspaces – Simultaneous Triangulation – Simultaneous Diagonalization.

**UNIT-II**

Direct – sum Decompositions – invariant direct sums – the primary decomposition theorem – cyclic subspaces and Annihilators – cyclic decompositions and the rational form.

**UNIT-III**

The Jordan Form – Computation of Invariant Factors – Semi Simple Operators.

**UNIT-IV**

Bilinear Forms : Bilinear Forms –Symmetric Bilinear Forms–Skew Symmetric Bilinear Forms – Group Preserving Bilinear Forms.

**Additional Module: (No question is given from this module)**

Inner product spaces – Linear functionals and adjoints.

**TEXT BOOK:** Linear Algebra second edition By Kenneth Hoffman and Ray Kunze, Prentice Hall of india Private Limited, New Delhi.

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**M.Sc Mathematics Degree Examinations**

**Semester: II**

**Syllabus{w.e.f 2020-2021 Admitted Batch}**

**Paper: M 205 - PROBABILITY THEORY & STATISTICS**

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**UNIT I**

Sample spaces and events, The Axioms of probability, some elementary Theorems, Boole's Inequality, Conditional Probability, Baye's Theorem.

**UNIT II**

Discrete & Continuous Random variables, mathematical Expectation, variance, covariance, moment generating functions, characteristic functions, Binomial, Poisson, Normal and Uniform Distributions.

**UNIT III**

Populations and samples, sampling distribution of the Mean ( $\sigma$  is known/unknown), sampling distribution of the variance and F distributions. Point estimation, Interval estimation, Tests of Hypotheses, Hypotheses concerning one and two means.

**UNIT IV**

Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions, The analysis of  $r \times c$  tables, Goodness of Fit. Correlation & Regression, The method of least squares, inferences bases on the least square estimators.

**Additional Module: (No question is given from this module)**

Choice of a regression model – Analysis of variance approach – Test for linearity of regression - Data plots and transformations – Simple linear regression case study.

**TEXT BOOKS:**

1. Fundamentals of Mathematical Statistics, SC Gupta, VK Kapoor [Only for First Two Units]
2. Probability & Statistics for Engineers & Scientists, Walpole Myers, Ye Pearson education.

**REFERENCE:**

1. Statistics and Random Processes by T. Veerarajan, Tata McGraw Hill.
2. Probability & Statistics, T.K.V. Iyengar, B. Krishna Gandhi and Others, S.Chand & Co.

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**M.Sc Mathematics Degree Examinations**

**Semester: IV**

**Syllabus{w.e.f 2020-2021 Admitted Batch }**

**Paper: M 401 – MEASURE THEORY**

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**UNIT-I**

Measure spaces, Measurable functions, Integration, general convergence theorems.

**UNIT-II**

Signed Measures, The Radon–Nikodym theorem, the Spaces

**UNIT-III**

Outer measure and measurability, The Extension theorem, Product measures.

**UNIT-IV**

Inner measure, Extension by sets of measure zero, Caratheodory outer measure, Hausdorff measure.

**TEXT BOOK:** H.L.Royden, Real Analysis, Macmillan Publishing Company, New York, Third Edition, 1988

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**M.Sc Mathematics Degree Examinations**

**Semester: IV**

**Syllabus{w.e.f 2020-2021 Admitted Batch}**

**Paper: M 402 – NUMERICAL ANALYSIS**

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**UNIT I**

Transcendental and polynomial equations: Introduction, Bisection method, Iteration methods based on first degree equation; Secant method, Regular Falsi method, Newton- Raphson method, Iteration method based on second degree equation; Muller's method, Chebyshev's method, Multi point iterative method, Rate of convergence of secant method

**UNIT II**

System of linear algebraic equation: Direct methods, Gauss elimination method, Triangularization method, Cholesky method, Partition method, Iteration method: Gauss seidel Iterative method.

**UNIT III**

Interpolation and Approximation: Introduction, Lagrange and Newton's divided difference interpolation, Finite difference operators, sterling and Bessel interpolation, Hermite interpolation, piecewise and Spline Interpolation, least square approximation.

**UNIT IV**

Numerical Differentiation: methods based on Interpolation, methods based on Finite difference operators Numerical Integration: methods based on Interpolation, Newton's cotes methods, methods based on Undetermined coefficients, Gauss Legendre Integration method, Numerical methods ODE: Single step methods: Euler's method, Taylor series method, Runge kutta second and forth order methods.

**ADDITIONAL MODULE:** OR Method, Multistep methods: Adam Bash forth method, Adam Moulton methods, Milne-Simpson method.

**Text Book:** [1] Numerical Methods for Scientific and Engineering computation by M.K. Jain, S.R.K. Iyengar, R.K. Jain, New Age Int. Ltd., New Delhi.

**Reference:** [1] Introduction to Numerical Analysis, by S.S. Sastry, Prentice Hall India

**GOVERNMENT AUTONOMOUS COLLEGE, RAJAMAHENDRAVARAM**  
(Accredited by NAAC “A<sup>+</sup>” Grade with 3.38 CGPA)

**M.Sc Mathematics Degree Examinations**

**Semester: IV**

**Syllabus{w.e.f 2020-2021 Admitted Batch}**

**Paper: M 403 - GRAPH THEORY**

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**UNIT I**

Basic concepts, Isomorphism, Euclidian and Hamilton Graphs, Trees, Properties of Trees, Spanning Trees, Connectivity and Separability, Network flows.

**UNIT II**

Planar graphs, Kuratowski's two graphs, Different representations of planar graphs, Detection of Planarity, Geometric and Combinational Duals of a graph, Vector spaces of a Graph

**UNIT III**

Matrix representation of graphs, Incidence and circuit matrices of a graph, Fundamental Circuit matrix, Application to a Switching network, Cut set and Path Matrices, Adjacency matrices, Directed Graphs, Trees with directed Edges, Incidence and adjacency matrix of a digraph.

**UNIT IV**

Coloring, Covering and Partitioning, Chromatic number, Chromatic Partitioning, Chromatic polynomial, Matchings, Coverings, The form color problem, Applications of graph theory in Operations Research.

**TEXT BOOK :** Graph Theory with applications to Engineering and Computer Science by Narasingh Deo; Prentice – Hall of India.

**REFERENCES:** 1. Graph Theory with applications by Bond JA and Murthy USR, North Holland, New York.

2. Introduction to Graph Theory by Donglas B.West. Prentice Hall of India.



**GOVERNMENT AUTONOMOUS COLLEGE, RAJAMAHENDRAVARAM**

**M.Sc MATHEMATICS**

**SEMESTER: IV**

**SYLLABUS {w.e.f 2020-2021 Admitted Batch}**

**PAPER: M 404 - LINEAR PROGRAMMING**

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**UNIT I**

Formulation of Linear Programming problems, Graphical solution of Linear Programming problem, General formulation of Linear Programming problems, Standard and Matrix forms of Linear Programming problems, Simplex Method.

**UNIT II**

Two-phase method, Big-M method, Method to resolve degeneracy in Linear Programming problem, Alternative optimal solutions, Solution of simultaneous equations by simplex Method, Inverse of a Matrix by simplex Method, Concept of Duality in Linear Programming, Comparison of solutions of the Dual and its primal.

**UNIT III**

Mathematical formulation of Assignment problem, Reduction theorem, Hungarian Assignment Method, Travelling salesman problem, Formulation of Travelling Salesman problem as an Assignment problem, Solution procedure.

**UNIT IV**

Mathematical formulation of Transportation problem, Tabular representation, Methods to find initial basic feasible solution, North West corner rule, Lowest cost entry method, Vogel's approximation methods, Optimality test, Method of finding optimal solution, Degeneracy in transportation problem, Method to resolve degeneracy, Unbalanced transportation problem.

**TEXT BOOKS:** [1] S. D. Sharma, Operations Research.

**REFERENCE BOOKS:** [1] Kanti Swarup, P. K. Gupta and Manmohan, Operations Research.

[2] H. A. Taha, Operations Research – An Introduction.

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**SEMESTER: IV**

**SYLLABUS {w.e.f 2020-2021 Admitted Batch}**

**PAPER: M 405.1 – DISCRETE DYNAMICAL SYSTEMS**

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**UNIT I**

Phase Portraits, Periodic Points and Stable Sets, Sarkovskii's theorem, Differentiability and its Implications [Hyperbolic, Attractive and Repelling Periodic Points]

**UNIT II**

Parameterized Families of Functions and Bifurcations; The Logistic Function Part I [Cantor Sets], Symbolic Dynamics and Chaos.

**UNIT III**

The Logistic Function Part II Topological Conjugacy, The Logistic Function Part III [Period Doubling Cascade], Newton's Method

**UNIT IV**

Numerical solutions of Differential Equations, The Dynamics of Complex functions [Newton's Method in Complex Plane], the Quadratic Family and Mandelbrot Set

**TEXT BOOK:** Richard M. Holmgren, A First Course in Discrete Dynamical Systems, Springer Verlag.

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**M.Sc MATHEMATICS**

**SEMESTER: IV**

**SYLLABUS {w.e.f 2020-2021 Admitted Batch}**

**PAPER: M 405.2 - OPERATOR THEORY**

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**UNIT I**

Banach fixed point theorem- application of Banach's theorem to linear equations - application of Banach's theorem to differential equations-application of Banach's theorem to integral equations

**UNIT II**

Approximation in normed spaces-Uniqueness, strict convexity-uniform approximation Chebyshev polynomials – Splines

**UNIT III**

Spectral theory in finite dimensional Normed spaces-basic concepts-spectral properties of bounded linear operators-further properties of Resolvent and spectrum-use of complex analysis in spectral theory

**UNIT IV**

Compact linear operator of normed spaces-Further properties of compact linear operators Spectral properties of compact linear operators on normed spaces-further spectral properties of compact linear operators

**TEXT BOOK:** Introductory Functional Analysis and Applications by Kreyszig, John Wiley and Sons, Delhi, 2001.

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**M.Sc MATHEMATICS**

**SEMESTER: IV**

**SYLLABUS {w.e.f 2020-2021 Admitted Batch}**

**PAPER: M 405.3 - ADVANCED DIFFERENTIAL EQUATIONS**

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**UNIT I**

Boundary value problems: Preliminaries – Sturm – Liouville Problem – Green's function – Application of Boundary Value Problem – Picard's theorem.

**UNIT II**

Oscillations of second order equations: Fundamental results – Sturm's Comparisons theorem – Elementary linear oscillations – Comparisons theorem of Hille – Wintner – oscillations of  $x'' + a(t)x = 0$

**UNIT III**

Stability of linear and nonlinear systems: preliminaries – Elementary critical points – system of equations with constant coefficients – Linear equation with constant coefficients – Lyapunov stability – stability of quasi linear systems – second order linear differential equations

**UNIT IV**

Equations with deviating arguments: Preliminaries – equations with constant delay – Equations with piecewise constant delay – a few other types of delay equations.

**TEXT BOOK:** S.G. Deo, V. Lakshmikantham and V. Raghavendra: Text book of ordinary Differential equations.