

MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR

**PROGRAM EDUCATIONAL OBJECTIVES (PEOS),  
PROGRAM OUTCOMES (POS) & PROGRAM SPECIFIC OUTCOMES  
(PSOS)**

**Department of Mathematics**

**B.Sc. (Mathematics)**

**Vision:** To become a premier center, promoting Mathematics locally and globally.

**Mission:** To provide necessary background for producing a meaningful career in Mathematics and related fields for acquiring, Mathematical skills and employability skills.

**Program Objectives:**

The objective of the Course is to provide students with sufficient knowledge of Mathematic. This will allow students:

- To develop the skill to write entrance exam conducted by IIT's/Universities to pursue PG and Integrated Ph. D and will shine as great Mathematicians.
- To develop confidence to appear for SSC (CGL), IBPS, RRB and Civil services exam and will occupy higher posts in administrative level.
- To prepare in advance to appear for TRB after completing B. Ed. and become a dedicated faculty.
- To develop teaching skills, Subject knowledge in the course of their study which will help them to shine in various fields including Education, IT, etc.
- To use their course as a training ground to develop their positive attitude, skills, this will enable them to become a multi facet personality shining in any chosen field.

**Programme Outcome:**

The graduates will understand the principles and theories of Mathematics so as to appreciate the inherent potentials of Mathematics.

**At the end of the B.Sc. (Mathematics) Programme, graduate**

- Acquires the ability to understand and analyze the problems.

- Develops the skill to think critically on abstract concepts of Mathematics.
- Acquires the ability to think independently paving way for life long learning
- Analyses the situation, make a mathematical problem and find its solution.
- Enhances Logical reasoning skills, arithmetic skills, aptitude skills communication skills, self confidence for better employability.
- Formulates and develops mathematical arguments in logical manner.
- Provides a systematic understanding of the concepts and theories of mathematical and computing their application in the real world.

**Programme Specific outcomes:**

Upon completion of B.Sc. Programme, the students will be able to:

- Understands the basic concepts of advanced Mathematics.
- Nurture problem solving skills, thinking, creativity through assignments, project work
- Creates Mathematical Models.
- Understanding of the fundamental axioms in mathematics and capability of developing ideas based on them.
- Inculcate mathematical reasoning.
- Prepare and motivate students for research studies in mathematics and related fields.
- Provide knowledge of a wide range of mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.
- Provide advanced knowledge on topics in pure mathematics, empowering the students to pursue higher degrees at reputed academic institutions.
- Assist students in preparing (personal guidance, books) for competitive exams e.g. NET, GATE, etc.

**Job options:**

Jobs directly related to Mathematics degree include:

- For SSC (CGL), IBPS, RRB and Civil services exam and higher level of administration services like IAS, IPS officers in Nationalized Banks, LIC etc. in different government departments.
- To become a dedicated faculty in schools.

• Courses Outcomes:

<u>Subjects taught</u>	<u>Outcome</u>
Geometry, Trigonometry And Matrices	<ul style="list-style-type: none"> <li>• find the polar equation of a line, circle, tangent and normal to conics</li> <li>• familiarize real and imaginary parts of a circular and hyperbolic functions of a complex variable</li> <li>• solve a System of Linear equations using the inverse of a matrix</li> <li>• familiarize characteristic roots and characteristic vectors.</li> <li>• to find the inverse of a matrix by Cayley-Hamilton theorem</li> </ul>
Calculus	<ul style="list-style-type: none"> <li>• Find the higher order derivative of the product of two functions.</li> <li>• Expand a function using Taylor's and Maclaurin's series.</li> <li>• Learn the concept of asymptotes and obtain their equations.</li> <li>• Learn about partial derivatives and its applications.</li> <li>• Find the area under a given curve, length of an arc of a curve when the equations are given in parametric and polar form.</li> <li>• Find the area and volume by applying the techniques of double and triple integrals</li> </ul>
Vector Calculus	<ul style="list-style-type: none"> <li>• Represent vectors analytically and geometrically, and compute dot and cross products for presentations of lines and planes,</li> <li>• Analyze vector functions to find derivatives, tangent lines, integrals, arc length, and curvature,</li> <li>• Evaluate double and triple integrals for area and volume,</li> <li>• Determine gradient, divergence and curl,</li> <li>• Simple applications of Gauss's theorem, Stokes' theorem and Green s' theorems.</li> <li>• To learn about the Cone, Cylinder, Central Conicoids and Paraboloid.</li> </ul>

<p>Numerical Methods</p>	<ul style="list-style-type: none"> <li>• Analyse different forms of equations and finding their roots</li> <li>• Understand relation between roots and coefficients</li> <li>• Derive numerical methods for approximating the solution of problems of continuous mathematics,</li> <li>• Analyze the error incumbent in any such numerical approximation,</li> <li>• Implement a variety of numerical algorithms using appropriate technology</li> <li>• Compare the viability of different approaches to the numerical solution of problems arising in roots of solution of non-linear equations, interpolation and approximation, numerical differentiation and integration, solution of linear systems.</li> </ul>
<p>MATHEMATICAL ANALYSIS</p>	<ul style="list-style-type: none"> <li>• Describe the real line as a complete, ordered field</li> <li>• Use the definitions of convergence as they apply to sequences, and functions,</li> <li>• Determine the continuity, differentiability, and integrability of functions defined on subsets of the real line</li> <li>• Apply the Mean Value Theorem and the Fundamental Theorem of Calculus to problems in the context of real analysis</li> </ul>
<p>DIFFERENTIAL EQUATIONS</p>	<ul style="list-style-type: none"> <li>• Obtain an integrating factor which may reduce a given differential equation into an exact one and eventually provide its solution.</li> <li>• Identify and obtain the solution of Clairaut's equation.</li> <li>• Find the complementary function and particular integrals of linear differential equation.</li> <li>• Familiarize the orthogonal trajectory of the system of curves on a given surface.</li> <li>• Methods of solution of the differential equation</li> <li>• Describe the origin of partial differential equation and distinguish the integrals of first order linear partial differential equation into complete, general and singular integrals.</li> </ul>

	<ul style="list-style-type: none"> <li>• Use Lagrange’s method for solving the first order linear partial differential equation</li> <li>• Solve and apply linear differential equations of second order (and higher),</li> <li>• Solve linear differential equations using the Laplace transform technique,</li> <li>• Find power series solutions of differential equations, and · Develop the ability to apply differential equations to significant applied and/or theoretical problem.</li> </ul>
<p>ABSTRACT ALGEBRA</p>	<ul style="list-style-type: none"> <li>• Assess properties implied by the definitions of groups and rings, · Use various canonical types of groups (including cyclic groups and groups of permutations) and canonical types of rings (including polynomial rings and modular rings),</li> <li>• Analyze and demonstrate examples of subgroups, normal subgroups and quotient group.</li> <li>• Analyze and demonstrate examples of ideals and quotient rings,</li> <li>• Use the concepts of isomorphism and homomorphism for groups and rings</li> <li>• Produce rigorous proofs of propositions arising in the context of abstract algebra</li> </ul>
<p>LINEAR ALGEBRA</p>	<ul style="list-style-type: none"> <li>• Understand the idea about vector space .</li> <li>• Analyze finite and infinite dimensional vector spaces and subspaces over a field and their properties, including the basis structure of vector spaces</li> <li>• Use the definition and properties of linear transformations and matrices of linear transformations and change of basis, including kernel, range and isomorphism</li> <li>• Compute with the characteristic polynomial, eigenvectors, eigen values and Eigen space.</li> </ul>

DISCRETE MATHEMATICS	<ul style="list-style-type: none"> <li>• Understand the new topics Graph Theory, Cryptography, Poset and Lattices</li> <li>• Understand the basic concepts of graphs, directed graphs, and weighted graphs and able to present a graph by matrices</li> <li>• Understand the properties of trees and able to find a minimal spanning tree for a given weighted graph</li> <li>• Understand Eulerian and Hamiltonian graphs</li> <li>• Apply the basic logic of Cryptography into various problems</li> <li>• Recognize lattices, complete ordered sets and their varieties · Know the standard tools of lattice theory</li> <li>• Know the main representation theorems of lattices</li> <li>• Be able to make use all the above both inside the theory and applications</li> </ul>
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### M. Sc. (Mathematics)

**Vision:** To enhance the logical and analytical skills in solving problems and to inculcate research culture among the students.

**Mission:** To organize, connect, create and communicate Mathematical concepts effectively through 4D's – Dedication, Determination, Discipline and Direction.

### Program Objectives:

The graduate will

- have the ability to pursue interdepartmental research in Universities in India and abroad.
- have the caliber to work in foreign Universities.
- shine in higher level of administration like IAS, IPS officers in Nationalized Banks, LIC, etc.,
- run renowned Educational institutions to serve the society.

### Programme Outcome:

**At the end of the M.Sc. (Mathematics) Programme, the graduates will be able to**

- Identify, formulate, and analyze the complex problems using the principles of Mathematics.
- Solve critical problems by applying the Mathematical tools.
- Apply the Mathematical concepts in all the fields of learning including higher research, and recognize the need and prepare for lifelong learning.
- Able to crack competitive examinations, lectureship and fellowship exams approved by UGC like CSIR – NET and SET.
- Apply ethical principles and commit to professional ethics, responsibilities and norms in the society.
- Inculcate critical thinking to carry out scientific investigation objectively without being biased with preconceived notions.
- Equip the student with skills to analyze problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions thereof.
- Prepare students for pursuing research or careers in industry in mathematical sciences and allied fields

**Programme Specific outcomes:**

Upon completion of M. Sc. Programme, the students will be able to:

- Understands the basic concepts of advanced Mathematics.
- Nurture problem solving skills, thinking, creativity through assignments, project work
- Creates Mathematical Models.
- Understanding of the fundamental axioms in mathematics and capability of developing ideas based on them.
- Inculcate mathematical reasoning.
- research studies in mathematics and related fields.
- mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.
- advanced knowledge on topics in pure mathematics, empowering the students to pursue higher degrees .
- prepare (personal guidance, books) for competitive exams e.g. NET, GATE, etc.

**Job options:**

Jobs directly related to Mathematics degree include:

- For SSC (CGL), IBPS, RRB and Civil services exam and higher level of administration services like IAS, IPS officers in Nationalized Banks, LIC etc. in different government departments.
- Research scientists (Mathematics).
- To become a dedicated faculty in schools.
- Lectures and Professors in colleges and universities.

**Courses Outcomes:**

<b>Subjects taught</b>	<b>Outcome</b>
<b>Topology</b>	<ul style="list-style-type: none"><li>• Define and illustrate the concept of topological spaces and continuous functions,</li><li>• Define and illustrate the concept of product topology and quotient topology,</li><li>• Prove a selection of theorems concerning topological spaces, continuous functions, product topologies, and quotient topologies,</li><li>• Define and illustrate the concepts of the separation axioms, Define connectedness and compactness, and prove a selection of related theorems.</li></ul>
<b>Complex Analysis</b>	<ul style="list-style-type: none"><li>• Represent complex numbers algebraically and geometrically,</li><li>• Define and analyze limits and continuity for complex functions as well as consequences of continuity,</li><li>• Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra,</li><li>• Analyze sequences and series of analytic functions and types of convergence,</li><li>• Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula, and</li></ul>



	<ul style="list-style-type: none"> <li>• Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.</li> </ul>
<b>Real Analysis</b>	<ul style="list-style-type: none"> <li>• evaluate the limits of a wide class of real sequences;</li> <li>• determine whether or not real series are convergent by comparison with standard series or using the Ratio Test;</li> <li>• understand the concept of continuity and be familiar with the statements and some proofs of the standard results about continuous real functions;</li> <li>• Understand the concept of the differentiability of a real valued function and be familiar with the statements of the standard results about differentiable real functions.</li> </ul>
<b>Measure Theory</b>	<ul style="list-style-type: none"> <li>• To understand the fundamental concepts of Mathematical Analysis.</li> <li>• To state some of the classical theorems in of Advanced Real Analysis.</li> <li>• To be familiar with measurable sets and functions.</li> <li>• To integrate a measurable function.</li> </ul>
<b>Functional Analysis</b>	<ul style="list-style-type: none"> <li>• Discuss various problems in different space: vector space, inner product space and Hilbert Spaces.</li> <li>• Explain the fundamental concepts of functional analysis.</li> <li>• Understand the approximation of continuous functions.</li> <li>• Understand concepts of Hilbert and Banach spaces .</li> <li>• Understand the definitions of linear functional and prove the Hahn-Banach theorem, open mapping theorem, uniform boundedness theorem, etc.</li> <li>• Define linear operators, self adjoint, isometric and unitary operators on Hilbert spaces.</li> </ul>
<b>Abstract Algebra</b>	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of group homomorphism, isomorphism and automorphism.</li> </ul>

	<ul style="list-style-type: none"> <li>• Derive and apply the First Isomorphism Theorem.</li> <li>• Demonstrate knowledge of conjugates, the Class Equation and Sylow theorems.</li> <li>• Derive and apply Sylow Theorems.</li> <li>• Solvable groups and associated properties, finite abelian groups.</li> <li>• Demonstrate knowledge of polynomial rings and associated properties.</li> <li>• Derive and apply Gauss Lemma, Eisenstein criterion for irreducibility of rationals.</li> <li>• Understand the characteristic of a field and the prime subfield. · Understand Factorization and ideal theory in the polynomial ring; the structure of a primitive polynomials</li> <li>• Understand Field extensions and characterization of finite normal extensions as splitting fields.</li> <li>• Understand the structure and construction of finite fields. · Understand radical field extensions.</li> <li>• Understand Galois group and Galois theory.</li> </ul>
<b>Theory of Ordinary and partial Differential Equation</b>	<ul style="list-style-type: none"> <li>• Be familiar with the modeling assumptions and derivations that lead to PDEs,</li> <li>• Recognize the major classification of PDEs and the qualitative differences between the classes of equations, and be competent in solving linear PDEs using classical solution methods.</li> </ul>
<b>Operation Research</b>	<ul style="list-style-type: none"> <li>• To apply the notions of linear programming in solving transportation problems.</li> <li>• To understand the theory of games for solving simple games.</li> <li>• To use linear programming in the formulation of shortest route problem and use algorithmic approach in solving various types of network problem.</li> <li>• To know the use of dynamic programming in various applications.</li> </ul>