MATHEMATICS

Course Outcome

📓 Semester I

Course: Algebra (MJC-O1 / MIC-O1)
Course Outcomes:

1. Employ De Moivre's theorem in a number of applications to solve numerical problems.
2. Apply Euclid's algorithm and backwards substitution to find the greatest common divisor.
3. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix using rank.

📓 Semester II

Course: Calculus & Geometry (MJC-02 / MIC-02)
Course Outcomes:

1. Apply derivatives in Optimization, Social sciences, Physics and Life sciences.
2. Compute the area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.

📓 Semester III

Course: Real Analysis (MJC-03 / MIC-03)
Course Outcomes:

1. Understand properties of the real line and define sequences via functions.
2. Recognize bounded, convergent, divergent, Cauchy, and monotonic sequences.
3. Apply convergence tests for infinite series of real numbers.

📓 Semester IV

Course: Ordinary Differential Equations (MJC-04 / MIC-04)
Course Outcomes:

1. Understand the concept of ODEs.
2. Solve first-order and higher-order linear differential equations using various techniques.
3. Apply these techniques to mathematical models.

Course: Theory of Real Functions (MJC-05 / MIC-05)
Course Outcomes:

1. Understand the concept of limit of a function.
2. Understand properties of continuous functions on closed intervals.
3. Apply Mean Value Theorems and Taylor's Theorem.

Semester V

Course: Group Theory (MJC-06 / MIC-06)
Course Outcomes:

1. Recognize groups and classify them (abelian, cyclic, etc.).
2. Understand cosets, normal subgroups, and factor groups.
3. Understand homomorphisms and isomorphisms.

Course: Partial Differential Equations (MJC-07 / MIC-07)
Course Outcomes:

1. Formulate, classify, and transform PDEs into canonical form.
2. Solve linear and non-linear PDEs.
3. Apply Laplace transforms for solving PDEs.

Semester VI

Course: Ring Theory and Linear Algebra-I (MJC-08 / MIC-08)
Course Outcomes:

1. Understand Rings, Fields, subrings, integral domains, and homomorphisms.
2. Understand linear independence, basis, and dimension of vector spaces.
3. Learn linear transformations, Rank-Nullity Theorem, and change of basis.

Semester VII

Course: Multivariate Calculus (MJC-09 / MIC-09)
Course Outcomes:

1. Understand calculus with multivariable functions.
2. Explore line, double, and triple integrals.
3. Apply calculus to physics, optimization, and geometry.

Course: Complex Analysis (MJC-10 / MIC-10)
Course Outcomes:

1. Understand Cauchy-Riemann equations and differentiability.
2. Evaluate contour integrals using Cauchy theorems.
3. Expand functions via Taylor and Laurent series and understand Möbius transformations.

Semester VIII

Course: Metric Space (MJC-11)
Course Outcomes:

1. Understand metric space concepts like open/closed balls and sets.
2. Explore continuity, compactness, and connectedness in abstract settings.
3. Apply fixed point theorems and understand completeness.

Course: Riemann Integration and Series of Functions (MJC-12)
Course Outcomes:

1. Understand Riemann integrability and applications.
2. Apply Beta and Gamma functions.
3. Analyze series of functions, including power series and uniform convergence.

Course: Ring Theory and Linear Algebra-II (MJC-13)
Course Outcomes:

1. Understand factorization in rings and integral domains.
2. Compute eigenvalues, eigenvectors, and diagonalize operators.
3. Apply inner products, Gram-Schmidt process, and study orthogonal operators.

Course: Numerical Methods (MJC-15)
Course Outcomes:

1. Apply numerical techniques for roots and systems of equations.
2. Use interpolation, differentiation, and integration methods.
3. Solve differential equations numerically.

Course: Mathematical Finance (MJC-16)
Course Outcomes:

1. Understand interest rate types and financial instruments.
2. Learn derivative pricing, hedging, and arbitrage.
3. Apply binomial and risk-neutral models for pricing.

Programme Outcome (PO): B.Sc. Mathematics (CBCS)

After successful completion of the undergraduate Mathematics programme, a student will be able to:

PO1: Foundational Knowledge in Mathematics

Demonstrate comprehensive knowledge of core mathematical areas including Algebra, Calculus, Real Analysis, Differential Equations, and Linear Algebra, enabling a solid grounding in both theory and computation.

PO2: Analytical and Logical Thinking

Apply mathematical reasoning to analyze and solve problems. Develop critical thinking and logical deduction skills necessary for mathematical proof and argument construction.

PO3: Mathematical Modeling and Problem Solving

Formulate and solve real-world problems using differential equations, numerical methods, and multivariate calculus. Translate physical or theoretical situations into mathematical models.

PO4: Abstract and Structural Understanding

Understand and work within abstract mathematical structures such as groups, rings, fields, and vector spaces. Apply the principles of structure and symmetry in pure mathematics.

PO5: Computational Proficiency and Tools Usage

Use numerical and computational techniques effectively, including the application of software or algorithms to solve mathematical problems. Demonstrate accuracy in approximations and error analysis.

PO6: Communication and Interpretation

Communicate mathematical ideas effectively using precise language, symbolic notation, and logical structure. Interpret and present data, formulas, and models clearly.

PO7: Research and Analytical Skills

Engage in independent inquiry and apply mathematical concepts in exploring advanced topics such as Complex Analysis, Metric Spaces, and Series of Functions.

PO8: Application in Interdisciplinary Domains

Apply mathematical tools and techniques in allied areas such as Physics, Computer Science, Finance, and Engineering. Understand the role of mathematics in modeling economic systems and physical phenomena.

PO9: Ethics and Professionalism

Demonstrate integrity and objectivity in mathematical work, ensuring accuracy, reproducibility, and ethical usage of knowledge and computational resources.

PO10: Lifelong Learning and Career Readiness

Develop the capacity for independent learning and adaptability to pursue higher studies, research, teaching, or careers in data analysis, actuarial science, finance, IT, and education sectors.

Integration of Crosscutting Issues in Mathematics Curriculum

◈ Professional Ethics

- **Application:** In topics like *Numerical Methods*, *Mathematical Finance*, and *Modeling*, ethical use of data, accuracy in computation, and responsible presentation of results are emphasized.
- **Outcome:** Students develop integrity in research and problem-solving, recognizing the impact of mathematical decisions on industries, technology, and society.

◈ Gender Sensitivity

- **Application:** Classroom discussions and examples are designed to be **inclusive**, avoiding gender bias. Encouragement is given to all genders equally in problem-solving, research, and presentation activities.
- **Outcome:** Promotes equity and creates an inclusive learning environment encouraging participation from all demographics.

◈ Human Values

- **Application:** Through historical insights in *Algebra*, *Group Theory*, and *Analysis*, students are introduced to contributions from diverse global cultures and mathematicians, fostering **respect** and **appreciation**.
- **Outcome:** Encourages values like perseverance, cooperation, critical thinking, and respect for diverse intellectual contributions.

◈ Environment and Sustainability

- **Application:** *Multivariate Calculus*, *Differential Equations*, and *PDEs* are used in modeling real-life scenarios including **climate patterns**, **population growth**, **resource optimization**, and **ecosystem dynamics**.
- **Outcome:** Students gain tools to understand and address environmental challenges through mathematical modeling, supporting sustainable practices.

Summary Table of Integration

Crosscutting Issue	Integrated In Courses	Approach/Impact
Professional Ethics	Numerical Methods, Mathematical Finance	Ethical modeling, precision, accountability
Gender Sensitivity	All courses (examples, group work, participation)	Inclusiveness in learning and collaboration

Crosscutting Issue	Integrated In Courses	Approach/Impact
Human Values	Algebra, Real Analysis, Group Theory	Highlighting multicultural contributions, critical thinking
Environment	Differential Equations, Multivariate Calculus	Modeling natural processes and sustainability
Sustainability	PDEs, Statistics, Optimization Techniques	Real-world applications for long-term solutions