SUBJECT: MATHEMATICS

B.Sc. Semester-I

Core Course-UMATC-101: Differential Calculus

Objective: The student should have a good mathematical background and have knowledge of topics like limits, differentiation and integration. This course will help the student to strengthen his mathematical concepts.

Learning Outcomes: -This course will enable the students to:

1. Calculate the limit and examine the continuity and understand the geometrical interpretation of differentiability.
2. Use critical points and signs of first and second derivatives to sketch graphs of functions.
3. Use the first derivative to find intervals where a function is increasing or decreasing.
4. Use the second derivative to determine concavity and find inflection points.
5. Apply the first and second derivative tests to classify critical points and use them to locate maxima and minima.
6. Sketch curves in Cartesian and polar coordinate systems. Polar coordinates are used often in navigation as the destination or direction of travel can be given as an angle and distance from the object being considered.
7. Use Differential Calculus to solve optimization problems appearing in social sciences, physical sciences, life sciences and a host of other disciplines.
8. Understand the consequences of various Rolle's theorem ,Mean value theorem, Taylor's theorem for differentiable functions.
9. Be able to understand ideas partial derivative of second and higher orders.

B.Sc. Semester-II

Core Course UMATC -201: Differential Equations

Objective: This course is of Differential equation. Student should have prerequisite knowledge of differential equations especially variable separable method, homogenous and linear differential equations.

Course Learning Outcomes:- This course will enable the students to:

1. Explain the meaning and concept of differential equation with respect to their order, degree and linearity.
2. Solves first-order ordinary differential equations.
3. Solves exact differential equations.
4. Converts separable and homogenous equations to exact differential equations by integrating factors.
5. Solves Bernoulli differential equations.
6. Find solution of higher-order linear differential equations.
7. Solves the homogeneous linear differential equations with constant coefficients.
8. Applies the method of undetermined coefficients to solve the non-homogeneous linear differential equations with constant coefficients.
9. Uses the method "variations of parameters" to find to solution of higher-order linear differential equations with variable coefficients.
10. Solves the Cauchy-Euler equations.

B.Sc. Semester-III

Core Course UMATC-301: Real Analysis

Objective: This course pertains to real analysis with emphasis on the sequence and series of real numbers. The student should have knowledge of real numbers and its properties, set theory, functions, etc.

Course Learning Outcomes:- This course will enable the students to:

1. Understand many properties of the real line $\mathbb{R}$ and learn to define sequence in terms of functions from $\mathbb{R}$ to a subset of $\mathbb{R}$.
2. Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
3. Apply various tests as the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.
4. Relate concepts of uniform continuity, differentiation, integration and uniform convergence.

B.Sc. Semester-III

Skill Enhancement Course UMATS-301: Logics, Sets And Relations

Objective: This course is of logic and sets. It will make them learn about propositions that are a type of statements and operations applied on them. This has a great application in circuit formations.

Course Learning Outcomes:- This course will enable the students to:

1. Apply the logic theory to practical situations for drawing conclusions
2. Analyze statements using truth tables.
3. Write and interpret mathematical notation and mathematical definitions.
4. Construct and restate various theorems using logical arguments.
5. Apply the logical structure of proofs and work symbolically with connectives and quantifiers to produce logically valid, correct and clear arguments.
6. Understand the basic theory of sets, perform set operations on finite and infinite collections of sets and be familiar with properties of set operations.
7. Explain the fundamental ideas of sets and functions.
8. Establish the relationship between various variables existing in a system.
9. Determine equivalence relations on sets and corresponding equivalence classes.

B.Sc. Semester-IV

Core Course UMATC-401: Abstract Algebra

Objective: This course will enhance the knowledge of students with new concepts in algebra, which they have not read before. The students should have a background of sets and logic to grasp the content of this course.

Course Learning Outcomes:-This course will enable the students to:

1. Understand the basic concepts of group actions and their applications.
2. Learn about the fundamental concepts of groups, subgroups, normal subgroups, isomorphism theorems, cyclic and permutation groups.

3. Know the fundamental concepts in ring theory such as the concepts of ideals, quotient rings, integral domains, and fields.

B.Sc. Semester-IV

Skill Enhancement Course UMATS -401: Vector Calculus

Objectives:- The concepts of this paper have wide application in physics and requires a knowledge **of limits, differentiation, integration, vectors and their operations**

Course Learning Outcomes:- This course will enable the students to:

1. Acquire the basic knowledge of vector differentiation and vector integration.
2. Determine and apply, the important quantities associated with scalar fields, such as partial derivatives of all orders, the gradient vector and directional derivative.
3. Determine and apply, the important quantities associated with vector fields such as the divergence, curl, and gradient.
4. Calculate line integrals along piecewise smooth paths.

B.Sc. Semester-V

Discipline Specific Elective Course UMATDSE-501: Linear Algebra

Objective:- It is an advanced study of algebra with details of spaces like vector spaces, their basis and linear transformations.

Course Learning Outcomes:- This course will enable the students to:

1. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.
2. Find eigen values and corresponding eigen vectors for a square matrix.
3. Understand the concept of real vector spaces, subspaces, basis, dimension and their properties.
4. Solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion.
5. Demonstrate understanding of linear independence, span, and basis.

6. Apply principles of matrix algebra to linear transformations.

B.Sc. Semester-V

Discipline Specific Elective Course UMATDSE-502: Matrices

Objective: This course titled as Matrices and deals in matrices of higher spaces as R^2, R^3 . It also specifies how spaces are transformed in other spaces.

Course Learning Outcomes:- This course will enable the students to:

1. Understand the concept of vector spaces, subspaces of R^3, basis, dimension and their properties.
2. Acquire the basic knowledge of translation, dilation, rotation, reflection of point, line and plane.
3. Apply matrix algebra, the matrix transpose, and the zero and identity matrices, to solve and analyze matrix equations.
4. Apply the formal definition of an inverse, and its algebraic properties, to solve and analyze linear systems.
5. Find eigen values and corresponding eigen vectors for a square matrix.
6. Apply the Rank, Basis, and Matrix Invertibility theorems to describe matrices and subspaces.
7. Apply Cayley-Hamilton theorem to compute inverse of matrices.

B.Sc. Semester-V

Skill Enhancement Course UMATS-501: Probability and Statistics

Objective: In this paper, the students will know about different type of probability distributions and mean, mode, variance and moment generating functions of random variables in these distributions. The students should have studied the basic course of probability.

Course Learning Outcomes:- This course will enable the students to:

1. Understand the basic concepts of probability.

2. Appreciate the importance of probability distribution of random variables and to know the notion of central tendency.
3. Understand central limit theorem which shows that the empirical frequencies of so many natural populations exhibit Binomial, Normal and Poisson distribution.

B.Sc. Semester-V

Generic Elective Course UMATGE -501: Numerical Ability –I

Objective: The concept of this paper is wildly applicable in competitive exams.

Course Learning Outcomes:- This course will enable the students to:

1. Obtain numerical solutions of algebraic and transcendental equations.
2. Find numerical solutions of system of linear equations and check the accuracy of the solutions.
3. Analyse data, construct hypothesis, solve problems reflecting on their work.
4. Understand the basic concepts of quantitative ability, logical reasoning skill.
5. Use mathematical ideas to solve real-world problems and be able to communicate mathematical ideas with others.
6. Apply short-cut methods for solving elementary problems in areas such as number system, HCF, LCM, algebra of linear equations, ratios and proportion, time and distance, trigonometry.

B.Sc. Semester-VI

Discipline Specific Elective Course UMATDSE-601: Numerical Methods

Objective: This course of Numerical Methods gives the knowledge in Statistics and numerical analysis that has a great application in present era.

Course Learning Outcomes:- This course will enable the students to:

1. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
2. Apply numerical methods to obtain approximate solutions to mathematical problems.

3. Derive numerical methods for various mathematical operations and tasks such as finite differences and operators, interpolation, differentiation, integration, and the solution of differential equations and check the accuracy of the solutions.
4. Analyse and evaluate the accuracy of common numerical methods.
5. Obtain numerical solutions of algebraic and transcendental equations.
6. Analyse data, construct hypothesis, solve problems reflecting on their work.
7. Understand the basic concepts of quantitative ability, logical reasoning skill.

B.Sc. Semester-VI

Discipline Specific Elective Course:-UMATDSE-602: Complex Analysis

Objective: Here we deal with different functions particularly the complex functions and their properties. The students should have background of real analysis and complex numbers.

Course Learning Outcomes:- This course will enable the students to:

1. Understand the algebra of complex numbers.
2. Understand the significance of differentiability and analytic Course Learning Outcomes:- This course will enable the students to:
3. Applicability of complex functions Cauchy- Riemann equations
4. Understand Complex integration, the Cauchy -Goursat theorem and Cauchy integral formula.
5. Apply Liouville's theorem in fundamental theorem of algebra.
6. Learn Taylor and Laurent series expansions of analytic functions, classify the nature of singularity, poles and residues and application of Cauchy Residue theorem.

B.Sc. **Semester-VI**

Skill Enhancement Course – UMATS-601: Analytical Geometry

Objective: This paper is a study of two and three-dimensional figures and how to trace them. It requires a pre knowledge of basic geometry.

Course Learning Outcomes:- This course will enable the students to:

1. Understand how to analyze and synthesize given data to solve problems in geometry.

2. Understand the basic ideas of circle, parabola, ellipse and hyperbola.

B.Sc. Semester-VI

Generic Elective Course -601: Numerical Ability

Objective: The concept of this paper is wildly applicable in competitive exams.

Course Learning Outcomes:- This course will enable the students to:

1. Learn about various interpolating and extrapolating methods.
2. Apply various numerical methods in real life problems.
3. Analyse data, construct hypothesis, solve problems reflecting on their work.
4. Develop and maintain problem-solving skills.
5. Use mathematical ideas to solve real-world problems.
6. Solve elementary problems in areas such as mensuration, commercial mathematic, geometry, probability and statistics.