

UNDERGRADUATE PROGRAMME: COURSE OUTCOMES

Name of the Programme: B.Sc. Mathematics

Name of the Class	Course Code	Course Title	Course Outcomes	
SEMESTER I				
F.Y.B.Sc.	MT-111	Algebra	CO1	Student should study sets, relations and functions as revision.
			CO2	Student should be able to calculate G.C.D and L.C.M using divisibility of integers and its properties.
			CO3	Student should know fundamental theorem of arithmetic, prime numbers, theory of congruences with properties and their applications in Fermat's theorem and Euclid's theorem.
			CO4	Student should know basic algebraic properties, modulus, conjugates, roots and nth roots of unity of complex numbers and application of De Moiver's theorem.
F.Y.B.Sc.	MT-112	Calculus – I	CO1	Student should study various properties of real numbers and its consequences.
			CO2	Student should know sequences and limits, convergence, boundedness of sequences with their theorems and examples.
			CO3	Student should know limits of functions with example, limit theorems with extension of limit concepts.
			CO4	Student should know continuous function, continuous function on intervals with various theorems and examples.
F.Y.B.Sc.	MT-113	Mathematics Practical	CO1	Student gains confidence in solving the problems.
			CO2	Using Maxima software student should study convergence and divergence of sequences, limits at infinity, graphical pictures of various curves and surfaces.
SEMESTER II				
F.Y.B.Sc.	MT-121	Analytical Geometry	CO1	Student should know the significance of second-degree equation in x and y so as to classify the nature of graph in two-dimension.
			CO2	Student should know various forms of planes and their equations of first degree in three variables.
			CO3	Student should be familiar with symmetrical

				and asymmetrical form of lines in 3-D obtain by intersection of two planes.
			CO4	Student should know various forms of sphere and significant points of equation of sphere.
F.Y.B.Sc.	MT-122	Calculus – II	CO1	Student should be familiar to obtain the derivative of different functions.
			CO2	Student can study different functions by converting them into simple series (Taylor & Maclaurin series).
			CO3	Student should know the techniques of solving the differential equations.
			CO4	Students should able to solve various real life problems using knowledge of differential equation.
F.Y.B.Sc.	MT-123	Mathematics Practical	CO1	Student gains confidence in solving the problems.
			CO2	Using Maxima software student should study convergence and divergence of sequences, limits at infinity, graphical pictures of various curves and surfaces.
SEMESTER III				
S.Y.B.Sc.	MT-231	Calculus of Several Variables	CO1	The student should know partial derivatives and differentiability with higher order with applications.
			CO2	Using the derivative test student should be able to find extreme values of various functions.
			CO3	The student should develop the skill of solving multiple integrals and their applications.
S.Y.B.Sc.	MT-232 (A)	Numerical Methods & its applications	CO1	Student should able to solve algebraic and transcendental equations by using different numerical methods.
			CO2	Student should able to know different interpolation formulae and apply them to interpolate the given data.
			CO3	Student should able to differentiate and integrate by different numerical methods.
			CO4	Student should able to solve ODE by various numerical methods.
S.Y.B.Sc.	MT-232 (B)	Graph Theory	CO1	A students should be able to work with graphs and identify certain parameters and properties of the given graphs
			CO2	Student should know connected graph with its properties.
			CO3	Student should able to apply various algorithm to find Euler and Hamiltonian path.
			CO4	Student should able to study trees with its properties and application.

S.Y.B.Sc.	MT-233	Mathematics Practical based on MT-231 & MT-232	CO1	The student develops theoretical, applied and computational skills.
			CO2	The student gains confidence in proving theorems and solving problems.
			CO3	Student should be able to plot 2D and 3D curves using Maxima software.

SEMESTER IV

S.Y.B.Sc.	MT-241	Linear Algebra	CO1	Student should be familiar with matrices and its application to solve the system of linear equation.
			CO2	The student should be able to identify a set as a vector space and to find dimension, row space, column space, null space, rank and nullity.
			CO3	Student should be able to study various vector spaces using linear transformation.

S.Y.B.Sc.	MT-242(A)	Vector Calculus	CO1	Student should be familiar with gradient, divergence and curl of the functions.
			CO2	Using gradient student can find tangent, plane and normal line to the surface.
			CO3	Student should be familiar to solve line, surface and volume integrals so as to solve many real-life problems.

S.Y.B.Sc.	MT-242(B)	Dynamical System	CO1	Student should be able to evaluate eigen values and eigen vectors of the matrix.
			CO2	Student should be able to solve first order equations and apply it in logistic population model.
			CO3	Student should be able to calculate real, complex, distinct and repeated eigen values
			CO4	Student should classify planner system and exponential of a matrix.

S.Y.B.Sc.	MT-243	Mathematics Practical based on MT-241 & MT-242	CO1	The student develops theoretical, applied and computational skills.
			CO2	The student gains confidence in proving theorems and solving problems of linear algebra, vector calculus and Dynamical System.
			CO3	Student should be able to solve various problems of linear algebra, vector calculus and Dynamical System using maxima software.

SEMESTER V

T.Y.B.Sc.	DSE-1A: MT- 351	Metric Spaces	CO1	Understand the introductory concepts of metric spaces
			CO2	Correlate these concepts to their counter parts in modern analysis by studying examples
			CO3	Learn to analyze mappings between spaces
			CO4	Attain background for advanced courses in real analysis, functional analysis, and topology

			CO5	Appreciate the abstractness of the concepts such as open balls, closed balls, compactness, connectedness etc. beyond their geometrical imaginations
T.Y.B.Sc.	DSE-1B: MT 352	Real Analysis-I	CO1	Learn the basic facts in logic and set theory
			CO2	Learn to define sequence in terms of functions from N to a subset of R and to understand several properties of the real line.
			CO3	Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
			CO4	Use the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.
T.Y.B.Sc.	DSE-2A: MT 353	Group Theory	CO1	Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
			CO2	Analyze consequences of Lagrange's theorem
			CO3	Learn about structure preserving maps between groups and their consequences.
			CO4	Explain the significance of the notion of cosets, normal subgroups, and factor groups.
T.Y.B.Sc.	DSE-1B: MT 354	Ordinary Differential Equations	CO1	Understand the genesis of ordinary differential equations.
			CO2	Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.
			CO3	Grasp the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.
T.Y.B.Sc.	MT 355(A) DSE-3A	Operations Research	CO1	Analyze and solve linear programming models of real-life situations.
			CO2	The graphical solution of LPP with only two variables, and illustrate the concept of convex set and extreme points. The theory of the simplex method is developed.
			CO3	The relationships between the primal and dual problems and their solutions with applications to transportation, assignment and two-person zero-sum game problem.
T.Y.B.Sc.	MT 356(B) DSE-3B	Number Theory	CO1	This course will enable the students to learn some of the open problems related to prime numbers.
			CO2	This course will enable the students to learn about number theoretic functions and modular

				arithmetic.
			CO3	The Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues.
T.Y.B.Sc.	DSE-1: MT357	Practical Course Lab-1 (on Metric Space and Real Analysis-I)	CO1	To develop the skill of solving the problems on metric spaces using theorems.
			CO2	To develop the skill of solving the problems on convergent, divergent, bounded, limit superior and limit inferior.
			CO3	To identify the convergence and divergence of series by applying various test.
T.Y.B.Sc.	DSE-2: MT 358	Practical Course Lab-II (on Group Theory and Ordinary Differential equations)	CO1	To develop the skill to classify various sets on the basis of groups and its properties.
			CO2	To develop the skill of prove the theorems and properties of various types of groups and subgroup.
			CO3	To develop the skill of problem solving of various differential equation by applying theorems.
T.Y.B.Sc.	DSE-3: MT 359	Practical Course Lab-III (on DSE-3A and DSE-3B)	CO1	Analyze and solve linear programming models of real-life situations.
			CO2	To develop the concept of formulate the real-life problem into LPP.
			CO3	This course will enable the students to solve some of the open problems related to prime numbers.
			CO4	This course will enable the students to solve the various examples about number theoretic functions and modular arithmetic.
T.Y.B.Sc.	SEC-1: MT - 3510	Programming in Python –I	CO1	The student will be able to explain basic principles of Python programming language.
			CO2	The student will implement object-oriented concepts
T.Y.B.Sc.	SEC-2: MT-3511	LaTeX for Scientific Writing	CO1	Write a simple LaTeX input document based on the article class.
			CO2	Turn the input document into pdf with the pdf latex program.
			CO3	Format Words, Lines, and Paragraphs.
			CO4	Understand how to present data using tables.

SEMESTER VI

T.Y.B.Sc.	DSE-4A: MT 361	Complex Analysis	CO1	Understand the significance of differentiability of complex functions leading to the understanding of Cauchy-Riemann equations.
			CO2	Evaluate the contour integrals and understand the role of Cauchy-Goursat theorem and the Cauchy integral formula.
			CO3	Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.
			CO4	Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.
T.Y.B.Sc.	DSE-4B: MT 362	Real Analysis- II	CO1	The course will enable the students to learn about some of the families and properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.
			CO2	The course will enable the students to learn about beta and gamma functions and their properties.
			CO3	The course will enable the students to learn about recognize the difference between pointwise and uniform convergence of a sequence of functions.
			CO4	Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability
T.Y.B.Sc.	DSE-5A: MT 363	Ring Theory	CO1	The fundamental concept of Rings, Fields, subrings, integral domains and the corresponding morphisms.
			CO2	Learn in detail about polynomial rings, fundamental properties of finite field extensions, and classification of finite fields.
			CO3	Appreciate the significance of unique factorization in rings and integral domains.
T.Y.B.Sc.	DSE-5B: MT 364	Partial Differential Equations	CO1	Formulate, classify and transform partial differential equations into canonical form.
			CO2	Solve linear partial differential equations using various methods and apply these methods in solving some physical problems.
			CO3	Solve Laplace equations using various analytical methods demonstrate uniqueness of solutions of certain kinds of these equations.
T.Y.B.Sc.	DSE-6A:	Optimization	CO1	Understand fundamentals of Network Analysis

	MT 365(A)	Techniques		using CPM and PERT.
			CO2	Solve a sequencing Problem for various jobs and machines.
T.Y.B.Sc.	DSE-6B: MT 366(B)	Computational Geometry	CO1	The course will enable the students to construct algorithms for simple geometrical problems.
			CO2	Characterize invariance properties of Euclidean geometry by groups of transformations.
			CO3	Describe and construct basic geometric shapes and concepts by computational means
T.Y.B.Sc.	MT 367 DSE-4	Practical Course Lab-1 (on Complex Analysis and Real Analysis-II)	CO1	To develop the skill of solving the problems on complex analysis using theorems.
			CO2	To develop the skill of solving the problems on Riemann integrable functions.
			CO3	Able to solve various examples on pointwise and uniform convergence.
T.Y.B.Sc.	MT 368 DSE-5	Practical Course Lab-II (on Ring Theory and Partial Differential Equations)	CO1	To develop the skill to classify various sets as ring, subring, field, integral domain etc.
			CO2	To classify the examples as PID, UFD, FD etc. using properties and theorems.
			CO3	To develop the skill of problem solving of various partial differential equation by applying theorems.
T.Y.B.Sc.	MT 369 DSE-6	Practical Course Lab-III (on DSE-6A and DSE-6B)	CO1	To develop the skill of drawing network diagram of project using PERT and CPM.
			CO2	To develop the skill of assigning the jobs in optimal sequence.
			CO3	To decide the feasible time of replacement of machines.
			CO4	Student should be able to transform two dimensional and three-dimensional objects by using different specified transformation matrix.
			CO5	Student should know and apply in real-life different types of 3-D projection.
T.Y.B.Sc	SEC-III: MT 3610	Programming in Python-II	CO1	Demonstrate the use of Python in Mathematics such as operations research and computational Geometry etc.
			CO2	Study graphics and design and implement a program to solve a real-world problem.
			CO3	The students will implement the concepts of data with python and database connectivity.
T.Y.B.Sc.	SEC-IV: MT 3611	Mathematics into LaTeX	CO1	The student will be able to typeset mathematical formulas, use nested list, tabular and array environments.
			CO2	Import figures and pictures that are stored in external files