Department of Mathematics

Mapping of the courses based on employability / entrepreneurship / skill development

Class	Course Name	Course Code	Unit number and topics focusing on Employability / Entrepreneurship / Skill development
FYBSc Semester 1	Calculus -I	RJSUMAT101	**Unit 1:** Understanding of density of rational numbers in set of real numbers, Nested intervals property and its applications. **Unit 2:** Learning Cauchy sequences for convergence of sequences. **Unit 3:** Drawing graphs of some standard real-valued functions like $\|x\|$, e^x, $\ln x$, $\sin x$, $\cos x$, $\frac{1}{x}$ etc.
FYBSc Semester 1	Algebra-I	RJSUMAT102	**Unit 2:** Skill involved in applying congruences, Euler's ϕ function, Properties of Euler's ϕ function, Euler's theorem, Fermat's theorem and Wilson's theorem. **Unit 3**: Learning of equivalence relation, Partition, Residue classes and partition of $\mathbb{Z}$, addition and multiplication modulo n in $\mathbb{Z}_n$.
FYBSc Semester 2	Calculus -II	RJSUMAT201	**Unit 1:** Learning Sequential definition and $\varepsilon - \delta$ definition of continuity, uniform continuity, Skill sets required to apply continuity in various fields of mathematics. **Unit 2:** Skill involved in applying Carath*é*odory's lemma to derive certain useful results. **Unit 3:** Skill involved in applying differentiation in various real-world problems.
FYBSc Semester 2	Algebra-II	RJSUMAT202	**Unit 1:** Skills of involving algorithms like Division algorithm, Euclid algorithm to study relation between roots and coefficients of polynomials, use of Eisenstein's Criterion for irreducibility of a polynomial with integer coefficients. **Unit 2:** Understanding counting principles, permutations and combinations of sets. **Unit 3:** Understanding of several methods to solve systems of linear equations.
SYBSc Semester 3	Multivariable calculus	RJSUMAT301	**Unit 1:** Skill to extend the concepts of limit, continuity, and differentiability for multivariable functions. **Unit 2:** Learning the concept, of total derivative and mixed partial derivatives. **Unit 3:** Applications to Geometry, methods

			learned in unit 1 &2 to solve related types of mathematical problems
SYBSc Semester 3	Algebra -III	RJSUMAT302	**Unit 1:** Learning the use of linear transformations to solve systems of linear equations. **Unit 2:** Learning to compute determinant by various methods. **Unit 3:** Understanding of inner product, orthogonal and orthonormal sets and procedure for orthonormalization.
SYBSc Semester 3	Discrete Mathematics	RJSUMAT303	**Unit 1:** Learning of permutation, signature of permutations, recurrence relations, obtaining recurrence relation in counting problems, skills involved in solving homogeneous as well as non-homogeneous recurrence relations by using iterative methods, solving a homogeneous recurrence relation of second degree using algebraic method. **Unit 2:** Understanding Addition and multiplication Principle, pigeonhole principle and their applications to geometric problems. **Unit 3:** Skills involved in Permutation and combination of sets and multi-sets, Principle of inclusion and exclusion and its applications
SYBSc Semester 4	Integral Calculus	RJSUMAT401	**Unit 1:** Learning of the procedure of approximation of area, concepts of upper and lower integrals, knowing the applications of FTC, **Unit 2:** Applying the concept of definite integral to solve various real-world problems, Understanding beta and gamma functions and their useful applications in mathematics. **Unit 3:** Learning to extend the concept integration to higher dimensions and their geometric interpretations.
SYBSc Semester 4	Algebra -IV	RJSUMAT402	**Unit 1:** Understanding of the concept of group and its various types. **Unit 2:** Learning of important properties of cyclic group. **Unit 3:** knowing Lagrange's theorem and its consequences such as Fermat's little theorem, Euler's theorem.
SYBSc Semester 4	Differential Equations	RJSUMAT403	**Unit 1:** Classification of differential equations and their solutions, applying differential equations to the problems of orthogonal trajectories, population growth, and finding the current at a given time. **Unit 2:** Knowing the condition for existence and uniqueness of solutions of differential equations,

			learning of various methods to solve second order linear differential equations. **Unit 3:** Skills involved in applying methods of undetermined and variation of parameters, knowing oscillatory behavior of solutions of special differential equations.
TYBSc Semester 5	Multivariable Calculus and Analysis	RJSUMAT501	**Unit 1:** Learning of some identities involving gradient, curl and divergence , defining line integrals of scalar and vector fields, learning of FTC for line integrals, skills involved in applications of Green's theorem. **Unit 2:** understanding of the concept of surface integrals for scalar and vector fields, applications of Stokes' theorem and Gauss divergence theorem. **Unit 3:** Developing of concepts of sequence and series for functions, learning of their behavior, skills involved in representation of standard functions using power series.
TYBSc Semester 5	Algebra-V	RJSUMAT502	**Unit 1:** Understanding of quotient groups and orthogonal transformations, Equivalence of orthogonal transformations and isometries fixing origin on a finite dimensional inner product space, Characterization of isometries as composites of orthogonal transformations and translation, Cayley-Hamilton Theorem and its Applications. **Unit 2:** Learning of eigen values and eigen vectors of linear transformation, Invariance of the characteristic polynomial and eigenvalues of similar matrices. **Unit 3:** Learning of geometric multiplicity and Algebraic multiplicity of eigen values, diagonalisation of a linear transformation, Applications to real Quadratic forms, Characterization of positive definite matrices in terms of principal minors.
TYBSc Semester 5	Topology of Metric Spaces-I	RJSUMAT503	**Unit 1:** Learning of the concept of metric space, various types of it, Structure of an open set in $\mathbb{R}$, developing skill to handle open sets, closed sets, limit points of a set, closure of a set. **Unit 2:** understanding distance of a point from a set, distance between two sets, diameter of a set in a metric space and bounded sets in a metric space, characterization of limit points and closure points in terms of sequences. **Unit 3:** Learning the concept of completeness and use of several theorems involving completeness.

TYBSc Semester 5	Number Theory and its Applications-I	RJSUMAT504	**Unit 1:** Knowing and understanding of applications of Fermat's theorem, Euler's theorem, Wilson's theorem, Chinese remainder theorem and methods of factorization. **Unit 2:** Learning the theory of Diophantine linear equations, applying Fermat's two squares theorem, sum of three squares, Lagrange's four squares theorem. **Unit 3:** Learning the process enciphering and deciphering , applying primes and congruences in the field of Cryptography.
TYBSc Semester 6	Complex Analysis	RJSUMAT601	**Unit 1:** Understanding of Limit and continuity, differentiability, analyticity for complex functions **Unit 2:** Learning of elementary functions in complex planes, skills involved in applying Cauchy's theory **Unit 3:** Understanding of Taylor's series and Laurent's series , develops skills to compute residue and its applications.
TYBSc Semester 6	Algebra-VI	RJSUMAT602	**Unit 1:** Learning of advanced theory of groups, isomorphism theorems, Properties of external direct products , criterion for direct product to be cyclic, Using Isomorphism to classify groups of orders ≤ 7. **Unit 2:** Learning of the concept of ring and its various types, proving of first and second isomorphism theorems for rings, correspondence theorem for rings. **Unit 3:** Developing the concept of different type of Ideals in rings, learning of Eisenstein's criterion for irreducibility of a polynomial over $\mathbb{Z}$, learning of the fact that every field is an ID and a finite ID is a field, Procedure of construction of quotient field of an integral domain.
TYBSc Semester 6	Topology of Metric Spaces-II	RJSUMAT603	**Unit 1:** Learning of compactness using cover and its important properties, examples of compact sets in different metric spaces, sequentially compact metric spaces. **Unit 2:** Study of continuous functions in metric spaces using $\varepsilon - \delta$ definition as well as in terms of sequence, learning the characterization of continuity at a point in terms of sequences, applications of contraction mapping principle and fixed point theorem. **Unit 3:** Learning the concept of connected metric spaces, path connectedness, characterization of

			connected and disconnected subsets, knowing the fact that connected subset of $\mathbb{R}^n$ is not necessarily path connected.
TYBSc Semester 6	Number Theory and its Applications-II	RJSUMAT604	**Unit 1:** Understanding use concepts and uses of finite continued fractions, **Unit 2:** Learning of relation between irrational numbers and infinite continued fractions, understanding that better approximations of irrational numbers can be done through continued fractions **Unit 3:** Understanding number theoretic functions such as sigma, tau, Euler's, and also special numbers such as Fermat numbers, Amicable numbers, perfect numbers and Messene numbers, skills involved to solve quadratic congruences through the help of quadratic reciprocity law.