Department of Mathematics

PROGRAMME SPECIFIC OUTCOMES& COURSE OUTCOMES

F. Y. B. Sc. (MATHEMATICS-Paper 1)

Programme Specific Outcomes: Aiming to equip students with an atmosphere where Mathematics can be learned and enjoyed, the department takes on two courses per semester in First Year B. Sc. Program. On the completion of first year of F.Y. B. Sc. programme, students would have:

(1) Acquired sufficient knowledge of fundamental principles, concepts, methods and a clear perception of how mathematical ideas and tools can be used to solve variety of problems in diverse fields.
(2) Developed rigour understanding of Real Analysis concepts preparing them for advanced & interdisciplinary studies.
(3) Strengthened their abilities to think, imagine, and apply to other fields of Science.

SEMESTER I

[USMT 101] CALCULUS - I (w.e.f 2020-2021)

Sr. No	LEARNING OBJECTIVE	LEARNING OUTCOMES
1)	Introduction to real number system, its order properties & LUB axiom	Students will understand Results such as Archimedean property, density theorems, Haudorff property for real numbers with proofs.
2)	Introduction to sequences and types of sequences such as bounded, unbounded, Monotone sequences and Cauchy sequence.	Relation between convergent sequences and bounded sequences, constructing convergent and divergent sequences and the number “e” as a limit of a sequence.

3)	Introduction to differential equations and various types of differential equations.	First order first degree differential equations and their solution besides knowing the applications of differential equations to orthogonal trajectories, population growth, and finding the current at a given time.

SEMESTER II

[USMT 201] CALCULUS II

Sr. No	LEARNING OBJECTIVE	LEARNING OUTCOMES
1)	Introduction to the concept of Limit and Continuous functions.	Students will understand Formal definition of limit of a function and how to calculate it. Several properties of continuous functions such as intermediate value theorem, Bolzano Weierstrass theorem and related applications with proofs.
2)	Introduction to the concept of derivative as a limit of a function and geometric interpretation as the slope of the tangent to the curve.	Leibnitz rule for finding the derivative of product of two functions and chain rule for composition of functions.
3)	Standard theorems such as Rolle 's theorem, LMVT, Cauchy's Mean value theorem, Taylor's theorem with proofs.	Several observations using Leibnitz theorem, f'(x) =0 implies f is a constant function, increasing and decreasing functions, second derivative test and sketching of several curves, series expansions of standard functions of cos x, sin x etc.

PRACTICALS FOR F.Y.B.Sc

USMTP01 – Practicals

Practicals for USMT101/ UAMT 101:

(1) Algebraic and Order Properties of Real Numbers and Inequalities

(2) Hausdorff Property and LUB Axiom of R, Archimedian Property.

(3) Convergence and divergence of sequences, bounded sequences, Sandwich Theorem.

(4) Cauchy sequences, monotonic sequences, non-monotonic sequences.

(5) Solving exact and non-exact, linear, reducible to linear differential equations.

(6) Reduction of order of Differential Equations, Applications of Differential Equations.

PRACTICALS FOR F.Y.B.Sc

USMTP02-Practicals

Practicals for USMT201 :

(1) Limit of a function and Sandwich theorem, Continuous and discontinuous function.

(2) Algebra of limits and continuous functions, Intermediate Value theorem, Bolzano-Weierstrass theorem.

(3) Properties of differentiable functions, derivatives of inverse functions and implicit functions.

(4) Higher order derivatives, Leibnitz Rule.

(5) Mean value theorems and its applications, L'Hospital's Rule, Increasing and Decreasing functions.

(6) Extreme values, Taylor's Theorem and Curve Sketching.

Department of Mathematics

COURSE OBJECTIVE & COURSE OUTCOMES

F. Y. B. Sc. (MATHEMATICS-II)

Course Objective: Unlike other Mathematical courses, combinatorial problems are typically not solvable using just a typical set of theorems, methods or formulae. Most of them require careful, logical scrutiny of various existing possibilities. Thus, the main goal of this course is the development of combinatorial problems solving skills in students.

SEMESTER I

[USMT 102] ALGEBRA - I

Sr. No	LEARNING OBJECTIVE	LEARNING OUTCOMES
1)	To acquaint students with knowledge of integers, divisibility & related results such as Euler theorem, Fermat's theorem, Wilson theorem etc.	After completing this topic, students will be able to explain: Statement of well ordering principle, principle of induction as its consequence, binomial theorem, how to find greatest common divisor of two integers using Euclidean algorithm, relationship between gcd and lcm, standard results such as Euclid's lemma, prime number's are infinite etc along with applications of Euler's theorem, Fermat's theorem & Wilson's theorem.
2)	To introduce students with the concept of functions & relations	After completing this topic, students will be able to explain: Concept of a function, its domain, co-domain, range, direct & inverse image of a set under a function, injective, subjective & bijective functions, composition of functions and its inverse,

		binary operation & relation as a function, congruence as an equivalence relation and related results with proofs.
3)	To acquaint students with the definition, theorems and sums associated with Polynomials.	After completing this topic, students will be able to explain: Definition of a polynomial over R, C, Q and Z, division algorithm for polynomials (without proofs): remainder theorem & factor theorem as its consequence, rational root theorem with proof, concept of irreducible polynomials & that $\sqrt{p}$ is an irrational number whenever p is prime, statement of fundamental theorem of Algebra and its applications.

SEMESTER II

[USMT 202] DISCRETE MATHEMATICS

Sr. No	LEARNING OBJECTIVE	LEARNING OUTCOMES
1)	To give basic knowledge about Preliminary Counting.	After completing this topic, students will be able to explain: Finite and infinite sets, countable and uncountable sets, Addition and multiplication Principle, counting sets of pairs, two ways counting. Stirling numbers of second kind and Pigeonhole principle simple and strong form and its applications to geometry.
2)	To acquaint students with the examples related to Advanced Counting.	After completing this topic, students will be able to solve problems related to: Permutation, combination of sets and multi-sets, circular permutations, Binomial and Multinomial Theorem, Pascal identity, Principal of inclusion and exclusion and its applications, derangements, explicit formula for d_n and deriving formula for

		Euler's function φ(n).
3)	To acquaint students with the definition, theorems and examples associated with Permutations and Recurrence relation.	After completing this topic, students will be able to solve examples connected with: Permutation of objects, Sn, composition of permutations, transpositions, signature of a permutation, even and odd permutations, cardinality of Sn, Recurrence Relations, homogeneous, non-homogeneous, linear, non-linear recurrence relation, obtaining recurrence relations of Tower of Hanoi, Fibonacci sequence, etc. in counting problems, solving homogeneous as well as non homogeneous recurrence relations by using iterative methods, solving a homogeneous recurrence relation of second degree using algebraic method .

Practicals for USMT102:

(1) Mathematical induction ,Division Algorithm, Euclidean algorithm in Z, Examples on expressing the gcd. of two non zero integers a&b as ma + nb for some m, n ∈ Z,

(2) Primes and the Fundamental theorem of Arithmetic, Euclid's lemma, there exists infinitely many primes of the form 4n − 1 or of the form 6n − 1.

(3) Functions, Bijective and Invertible functions, Compositions of functions.

(4) Binary Operation, Equivalence Relations, Partition and Equivalence classes.

(5) Polynomial (I)

(6) Polynomial (II)

Practicals for USMT202:

(1) Counting principles, Two way counting.

(2) Stirling numbers of second kind, Pigeon hole principle.

(3) Multinomial theorem, identities, permutation and combination of multi-set.

(4) Inclusion-Exclusion principle. Euler phi function.

(5) Composition of permutations, signature of permutation, inverse of permutation.

(6) Recurrence relation.