UNIVERSITY OF MUMBAI

Syllabus

for F. Y. B. Sc. / F. Y. B. A. Semester I & II (CBCS)

Program: B. Sc. / B. A.

Course: Mathematics

with effect from the academic year 2020-2021

F. Y. B. Sc. (CBCS) SEMESTER I

CALCULUS I				
Course Code	UNIT	TOPICS	Credits	L/Week
USMT 101	I	Real Number System	2	3
	II	Sequences in $\mathbb{R}$		
	III	First Order First Degree Differential Equations		
ALGEBRA I				
USMT 102	I	Integers and Divisibility	2	3
	II	Functions, Relations and Binary Operations		
	III	Polynomials		
PRACTICALS				
USMTP01	-	Practicals based on USMT101, USMT102	2	2

F. Y. B. A. (CBCS) SEMESTER I

CALCULUS I				
Course Code	UNIT	TOPICS	Credits	L/Week
UAMT 101	I	Real Number System	3	3
	II	Real Sequences		
	III	First Order First Degree Differential Equations		
Tutorials				
	-	Tutorials based on UAMT101		

F. Y. B. Sc. (CBCS) SEMESTER II

CALCULUS II				
Course Code	UNIT	TOPICS	Credits	L/Week
USMT 201	I	Limits and Continuity	2	3
	II	Differentiability of functions		
	III	Applications of Differentiability		
DISCRETE MATHEMATICS				
USMT 202	I	Preliminary Counting	2	3
	II	Advanced Counting		
	III	Permutations and Recurrence Relation		
PRACTICALS				
USMTP02	-	Practicals based on USMT201, USMT202	2	2

F. Y. B. A. (CBCS) SEMESTER II

CALCULUS II				
Course Code	UNIT	TOPICS	Credits	L/Week
	I	Limits and Continuity		
	II	Differentiability of functions		
UAMT 201	III	Applications of Differentiability	3	3
TUTORIALS				
	-	Tutorials based on UAMT201		

PRACTICALS FOR F.Y.B.Sc
USMTP01 – Practicals

A. **Practicals for USMT101/ UAMT 101:**

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

    (2) Hausdorff Property and LUB Axiom of $\mathbb{R}$, 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.

    (7) Miscellaneous Theoretical Questions based on full paper.

B. **Practicals for USMT102:**

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

    (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)

    (7) Miscellaneous Theoretical Questions based on full paper.

TUTORIALS FOR F.Y.B.A

Tutorials for UAMT101 :

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

(2) Hausdorff Property and LUB Axiom of $\mathbb{R}$, 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.

(7) Miscellaneous Theoretical Questions based on full paper.

(2) Recurrence Relations, definition of 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 proving the necessary result.

Recommended Books:

1. Norman Biggs, Discrete Mathematics, Oxford University Press.

2. Richard Brualdi, Introductory Combinatorics, John Wiley and sons.

3. V. Krishnamurthy, Combinatorics-Theory and Applications, Affiliated East West Press.

4. Discrete Mathematics and its Applications, Tata McGraw Hills.

5. Schaum's outline series, Discrete mathematics,

6. Allen Tucker, Applied Combinatorics, John Wiley and Sons.

7. Sharad Sane, Combinatorial Techniques, Springer.

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PRACTICALS FOR F.Y.B.Sc
USMTP02-Practicals

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A. **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.
 (7) Miscellaneous Theoretical Questions based on full paper.

B. **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.
 (7) Miscellaneous Theoretical Questions based on full paper.

TUTORIALS FOR F.Y.B.A

Tutorials for UAMT201 :

(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.

(7) Miscellaneous Theoretical Questions based on full paper.

Scheme of Examination (75:25)

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 25 percent marks in the first part and by conducting the Semester End Examinations with 75 percent marks in the second part. The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below:-

I. **Internal Evaluation of 25 Marks:**

   F.Y.B.Sc. :
   - (i) One class Test of 20 marks to be conducted during Practical session.
     Paper pattern of the Test:
     Q1: Definitions/ Fill in the blanks/ True or False with Justification (04 Marks).
     Q2: Multiple choice 5 questions. (10 Marks: 5×2)
     Q3: Attempt any 2 from 3 descriptive questions. (06 marks: 2×3)
   - (ii) Active participation in routine class: 05 Marks.

   F.Y.B.A. :
   - (i) One class Test of 20 marks to be conducted during Tutorial session.
     Paper pattern of the Test:
     Q1: Definitions/ Fill in the blanks/ True or False with Justification (04 Marks).
     Q2: Multiple choice 5 questions. (10 Marks: 5×2)
     Q3: Attempt any 2 from 3 descriptive questions. (06 marks: 2×3)
   - (ii) Journal : 05 Marks.

II. **Semester End Theory Examinations :** There will be a Semester-end external Theory examination of 75 marks for each of the courses USMT101/UAMT101, USMT102 of Semester I and USMT201/UAMT201, USMT202 of semester II to be conducted by the college.

1. Duration: The examinations shall be of 2 and $\frac{1}{2}$ hours duration.

2. Theory Question Paper Pattern:

   a) There shall be FOUR questions. The first three questions Q1, Q2, Q3 shall be of 20 marks, each based on the units I, II, III respectively. The question Q4 shall be of 15 marks based on the entire syllabus.

   b) All the questions shall be compulsory. The questions Q1, Q2, Q3, Q4 shall have internal choices within the questions. Including the choices, the marks for each question shall be 25-27.

   c) The questions Q1, Q2, Q3, Q4 may be subdivided into sub-questions as a, b, c, d & e, etc and the allocation of marks depends on the weightage of the topic.

3. **Semester End Examinations Practicals:**

   At the end of the Semesters I & II Practical examinations of three hours duration and 100 marks shall be conducted for the courses USMTP01, USMTP02.
   In semester I, the Practical examinations for USMT101 and USMT102 are held together by the college.
   In Semester II, the Practical examinations for USMT201 and USMT202 are held together by the college.

   Paper pattern: The question paper shall have two parts A and B.
   Each part shall have two Sections.

   Section I Objective in nature: Attempt any Eight out of Twelve multiple choice questions (04 objective questions from each unit) ($8 \times 3 = 24$ Marks).

   Section II Problems: Attempt any Two out of Three (01 descriptive question from each unit) ($8 \times 2 = 16$ Marks).

Practical Course	Part A	Part B	Marks out of	duration
USMTP01	Questions from USMT101	Questions from USMT102	80	3 hours
USMTP02	Questions from USMT201	Questions from USMT202	80	3 hours

Marks for Journals and Viva:
For each course USMTP01 (USMT101, USMT102) and USMTP02 (USMT201, USMT202):

1. Journal: 10 marks (5 marks for each journal).

2. Viva: 10 marks.

Each Practical of every course of Semester I and II shall contain at least 10 objective questions and at least 6 descriptive questions.
A student must have a certified journal before appearing for the practical examination.
In case a student does not posses a certified journal he/she will be evaluated for 80 marks.
He/she is not qualified for Journal + Viva marks.

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