JAI HIND COLLEGE

Basantsing Institute of Science & J. T. Lalvani College of Commerce.

And Sheila Gopal Raheja College of Management

Affiliated to University of Mumbai

Autonomous

Bachelors of Science (B.Sc in Mathematic)

Course Code: SMAT101	Course Title: Calculus I

Learning Objectives:

1. To introduce real numbers and subsets of reals such as the set of rational numbers, set of irrational numbers and variety of applications of differential equations.

2. To understand properties of real numbers such as Density of rational numbers and irrational numbers, Hausdorff property.

3. To apply Fundamental theorems in real analysis like Archimedean property, Bolzano-Weierstrass theorem.

Learning Outcomes:

1. Formulate and solve problems properties of real numbers.
2. Illustrate Fundamental theorems on Archimedean property.
3. Describe Bolzano-Weierstrass theorem.

Course Code: SMAT102	Course Title: Algebra I

Learning Objectives

1. To introduce sets, functions and relations and bijective functions.

2.   To understand the concept of divisibility in integers and study the principle of mathematical induction by solving linear Diophantine equations.

3. To study theory of congruences and its applications like Euler's theorem, Fermat's little theorem.

Learning Outcomes:

1. Discuss basic concepts like sets, functions, relations, equivalence relations.

2. Evaluate theorems, lemmas using induction, proof by contradiction.

3. Describe divisibility in integers, division algorithm, Euclidean algorithm and Linear Diophantine equation

Semester I

Course Code: SMAT1PR1	Course Title: Practical -I (Based on SMAT 101 and SMAT 102)

Learning Objective:
To help them Solving exact and inexact differential equations.

To make them Solving linear differential equations,Bernoulli's Differential Equation Sanditsapplicatio
ns.
To define Problems Based On Absolute Value And Properties Of.

Learning Outcome:
Solving exact and non-exact differential equations.

Solving Linear Differential Equations,Bernoulli's Differential Equations And Its Application
ns.
Solve Problems based on absolute value and properties of.
Evaluate ProblemsonboundedsetsandArchimedeanproperty

Course Code: SMAT201	Course Title: Calculus II

Learning Objectives:
1. To expose students to the beauty of the definition of limit of a function, continuity and the concept of differentiation.
2. To learn the definition of continuity and sequential continuity and the equivalence between them.
3. To understand the notion of differentiation of a real valued function and mean value theorems.

Learning Outcomes:

1. Define of limit of a function and continuity.
2. Discuss Sandwich theorem, Intermediate value theorem
3. Apply limits and continuity.

Semester II

Course Code: SMAT202	Course Title: Algebra II

Learning Objectives:

1. To introduce a system of linear equations, matrices and vector spaces.

2. To introduce the definition of permutation of a set, its cycle notation, order and signature of permutation and study symmetries of equilateral triangles, squares and rectangles.

3. To understand the definition of polynomials over a given field, division algorithm for polynomials over, roots of a polynomial and its multiplicity, roots of unity and study the remainder theorem, factor theorem and rational root theorem.

Learning Outcomes:

1. Solve System of linear equations and interpret it geometrically.

2. Define permutations and get acquainted with its properties, transpositions, order and signature of a permutation.

3. Evaluate gcd of two polynomials over. Use Euclidean Algorithms and solve problems based on that.

Semester II

Course Code: SMAT2PR1	Course Title: Practical-II (Based on SMAT 201 , SMAT 202)

Learning Objectives:
To make them understand about Functions (image and inverse image), injective, surjective, bijective functions finding inverse of bijective functions.
(To train them with Problems Countability.
To train them with Problems Mathematical Induction,Euclidean Algorithm In.

Learning Outcome:
Functions (image and inverse image), injective, surjective, bijective function.
(1) solve Problems Countability.
(2) define Problems On Mathematical Induction,Euclidean Algorithm In.
(3) hypothesis on fundamental theorem of arithmetic and solving linear Diophantine equation.

Course Code: SMAT301	Course Title: Calculus and Differential Equations III

Learning Objectives

1. To increase the understanding of differentiation in higher dimensions.
2. To train them with higher order differentiation in solving equation
3. To make them aware about condition based theorem on differentiation

Learning Outcomes

1 Summarize modern engineering problems.
2.Solve problems on differentiation
3.evaluate equation based on higher order differentiation.

Semester III

Course Code: SMAT302	Course Title: Linear Algebra I

Learning Objectives:
To make them aware about System of linear equations
To help them with Definition and examples of vector spaces, vector subspaces, linear

span of finitely many vectors is a subspace.
To help them solving Intersection and sum of
two subspaces is a subspace, Union of two subspaces is not a
subspace in general. Union of two subspaces is a subspace if one is
contained in the other.

Learning Outcomes:
1.use System of linear equations
2.define with examples of vector spaces, vector subspaces, linear
span of finitely many vectors is a subspace.
3.solve Intersection and sum of
two subspaces is a subspace, Union of two subspaces is not a
subspace in general. Union of two subspaces is a subspace if one is
contained in the other.

Semester III

Course Code: SMAT303	Course Title: Data Analytics I

Learning Objective:
1.To make them, aware about Types of characteristics:
(a) Attributes: Nominal scale, ordinal scale,
(b) Variables: Interval scale, ratio scale, discrete and continuous
variables, difference between linear scale and circular scale
2.To sensitize them with types pf data like
(a) Primary data, Secondary data
(b) Cross-sectional data, time series data, directional data.
3.To help them understanding Classification: Raw data and its classification, ungrouped
frequency distribution, Sturges' rule, grouped frequency

Learning Outcomes:
1.Differentiate Types of characteristics:
(a) Attributes: Nominal scale, ordinal scale,
(b) Variables: Interval scale, ratio scale, discrete and continuous

variables, difference between linear scale and circular scale

2.Distinguish types pf data like

(a) Primary data, Secondary data

(b) Cross-sectional data, time series data, directional data.

3.Classify Raw data and its classification, ungrouped

frequency distribution, Sturges' rule, grouped frequency

Semester III

Course Code: SMATPR1	Course Title: Practical (Based on SMAT 301)

Learning Objectives:

To help them to findExamples on Convergent series. Cauchy's criterion. Problems based on test of Convergence of a series

To train them to find Examples on Alternating series, Leibnitz's test, Absolute convergence

Sequences, Limit and Continuity

Computing directional derivatives, partial derivatives

To make them aware about Problems on total derivative

Learning Outcomes:

Give Examples on Convergent series. Cauchy's criterion. Problems based on test of Convergence of a series

Use Examples on Alternating series, Leibnitz's test, Absolute convergence

Sequences, Limit and Continuity

Compute directional derivatives, partial derivatives

And Problems on total derivative

Semester III

Course Code: SMATPR2/	Course Title: Practical (Based on SMAT 302, 303)

Learning Objectives:

To train them with Graphical representation of statistical data: histogram, frequency curve and ogive curves.

To help them in Determination of mode and median graphically

To help them in Computation of measures of central tendency and dispersion (grouped data)

Learning Outcome:

Graphical representation of statistical data: histogram, frequency curve and ogive curves.

Determine mode and median graphically.

Compute measures of central tendency and dispersion (grouped data)

Course Code: SMAT401	Course Title: Calculus-IV

Learning Objectives:

1. To help students develop effective strategies for solving both mathematical and real world problems.
2. To create mathematical models.
3. To develop effective strategies for solving problems in applied settings and non-routine situations.

Learning Outcomes:

1. Discuss multi-variable and Metric Spaces.
2. Design a suitable mathematical model.
3. Solve complicated calculus problems.

Semester IV

Course Code: SMAT402	Course Title: Linear Algebra-II

Learning Objectives:

1. To gain basic Knowledge of set theory and multivariable function
2. To apply face detection software
3. To create mathematical modelling

Learning Outcomes:

1. Describe eigenvalues and eigenvectors
2. Evaluate computational ability of application of mathematics in real situations.
3. Design a face detection software using mathematical modelling.

Semester IV

Course Code: SMAT403	Course Title: Data Analytics-II

Learning Objectives:

1. To apply the central limit theorem.
2. To understand hypothesis testing and using various sampling methods.
3. To study simple and multiple regression with applications like prediction.

Learning Outcomes:

1. Describe data analysis in quantitative research.
2. Apply skills of mathematical modelling.
3. Design an experiment on machine learning and data analytics.

Course Code: SMATPR4	Course Title: Practical (Based on SMAT 401, 402 and 403)

Learning Objectives:
    1. To help in Problems on Riemann integral.
To train them to solve Problems on fundamental theorem of calculus, mean value theorems
To help them to Find area of a region between curves.

Learning Outcome:
Work on Problems on Riemann integral.
solve Problems on fundamental theorem of calculus, mean value theorem
 Find the area of a region between curves.

Semester V

Course Code: SMAT501	Course Title: Integral Calculus

Learning Objectives:
    (1) To apply integral calculus in physics and engineering.
    (2) To make students competent in solving real world maths problem.
    (3) To help students to pursue research in applied mathematics.

Learning Outcome:
1. Discuss the applications of integral calculus in physics and engineering.
2. Apply concepts of integral calculus in real world maths problems.
3. Explain research in applied mathematics

Semester V

Course Code: SMAT502	Course Title: Algebra I

Learning Objectives:

(1) To familiarise students with the notion of orthogonal transformation and isometries.

(2) To find eigenvalues and eigenvectors.

(3) To diaganilise a matrix

Learning Outcome:
1. Discuss the notion of orthogonal transformation and isometries.
2. Summarize eigenvalues and eigenvectors.
3. Describe diaganilisation of a matrix.

Course Code: SMAT503	Course Title: Topology of metric spaces

Learning Objectives:

(1) To solve problems of continuity over different metric spaces.

(2) To enhance the ability to analyse mathematical problems geometrically.

(3) Introducing compact sets which have nice properties and these sets are used in proving important theorems of topology.

Learning Outcome:
1. Enlist problems of continuity over different metric spaces.
2. Analyse mathematical problems geometrically.
3. Summarise important theorems of topology.

Semester V

Course Code: SMAT504	Course Title: Numerical Analysis I

Learning Objective:

(1) To learn different numerical methods to solve algebraic equations.
(2) To understand transcendental equations.
(3) To solve a system of equations that is used in all areas of science.

Learning Outcome:
1. Discuss different numerical methods to solve algebraic equations.
2. Evaluate transcendental equations.
3. Solve system of equations that is used in areas of science

Course Code: SMAT5PR I	Course Title: Practical-I(Based on SMAT 501,SMAT 502)

Learning Objective:
Evaluation of double and triple integral
Problem based on Line integrals of scalar and vector fields.
Examples on Homomorphism and isomorphism of groups

Learning Outcome:

Evaluate of double and triple integral
Use Line integrals of scalar and vector fields.
Differentiate Homomorphism and isomorphism of groups

Semester V
Course Code: SMAT5PR 2
Course Title:Practical-II(Based on SMAT503, SMAT 504)

Learning Objective:

To make them aware about Problems on Limit point and Derived set in a metric space.
To help them solve Problems on convergent sequences, dense sets, Cauchy sequence, subsequences in metric spaces.
To help them Create tables using different applications. Develop an application to create dimension tables in a cube and form star schema and snowflake schema.
Learning Outcome:

Solve Problems on Limit point and Derived set in a metric space.
Sort Problems on convergent sequences, dense sets, Cauchy sequence, subsequences in metric spaces.
Create tables using different applications. Develop an application to create dimension tables in a cube and form star schema and snowflake schema.

Course Code: SMAT5AC	Course Title: Applied Component Theory

Learning Objective :
1. To make them aware about programming based on I/O concepts
2. To inculcate knowledge on control statement
3. To help them understand on concepts of R data structure and control flow.

Learning Outcome

analyse Programs based on I/O concepts.

solve Programs based on Control Statement.

create Programs based on R data structures, R Control flow

Semester V

Course Code: SMAT5ACPR	Course Title: Applied Component Practical

Learning Objective:

· to introduce various concepts of programming to the students using Python and R.

To help them understand programming concepts.

To make them familiar with problem solving skills

Learning Outcome:

· Develop Python Programs on their own,

· Apply problem solving skills and implement any real world problems,

Use R for statistical programming, computation, graphics, and modelling,

Semester VI

Course Code: SMAT601	Course Title: Real and Complex analysis

Learning Objective:

    (1)   To apply Real and Complex analysis in physics and engineering.
    (2)   To make students competent in solving real world maths problem.
    (3)   To encourage students to pursue research in applied mathematics.

Learning Outcome:

1. Explain Real and Complex analysis in physics and engineering.
2. Solve the given problems in real world.
3. Illustrate research in applied mathematics.

Semester VI

Course Code: SMAT602	Course Title: Algebra II

Learning Objectives:

1. To make them aware about the Objectives Review of Groups, Subgroups, Abelian groups, Order of a group.

3. To make them aware of the finite and infinite groups

2. To help them in understanding Cyclic groups, permutation groups, cosets, Lagrange's theorem, Normal subgroups of a group, Quotient groups.

Learning Outcomes:

1. Summarize Objectives Review of Groups, Subgroups, Abelian groups, Order of a group.
3. Differentiate finite and infinite groups

2. Analyse Cyclic groups, permutation groups, cosets, Lagrange's theorem, Normal subgroups of a group, Quotient groups.

Semester VI

Course Code: SMAT603	Course Title: Metric Topology

Objectives

(i) TO make them aware aboutt Characterization of a connected space, namely a metric space X
is connected if and only if every continuous function from X to

$\{1, -1\}$ is a constant function.

(ii) to train them with concepts on Connected subsets of a metric space, connected subsets of   .

(iii) to help them with continuous images of a connected set is connected.

Learning Outcomes:

Characterize connected space, namely a metric space X

        is connected if and only if every continuous function from X to

    $\{1, -1\}$ is a constant function.

  (ii) tConnect subsets of a metric space, connected subsets of   .

  (iii) draw image of a connected set.

Semester VI

Course Code: SMAT604	Course Title: Numerical Analysis II

Learning Objectives

  (1) to make them aware about Interpolating polynomials, uniqueness of interpolating polynomials. Linear, Quadratic and
      higher order interpolation. Lagrange's Interpolation.

    (2)   To hel them to understand Finite difference operators: Shift operator, forward, backward and central difference operator, Average operator and relation between them. Difference table, Relation between difference and derivatives.

3.to inculcate knowledge on Interpolating polynomials using finite differences

Learning Outcomes:

  1.defienInterpolating polynomials, uniqueness of interpolating polynomials. Linear, Quadratic and
      higher order interpolation. Lagrange's Interpolation.

(2)   solve problems on Finite difference operators: Shift operator, forward, backward and central difference operator, Average operator and relation between them. Difference table, Relation between difference and derivatives.

3.summerize Interpolating polynomials using finite differences

Semester VI

Course Code: SMAT6PR1	Course Title: Practical-I(Based on SMAT 601,SMAT 602)

Learning Objectives:

(1)   This course has a wide variety of applications in physics and engineering.

    2.to inculcate knowledge on being competent in solving real world math problems. To help students to pursue research in applied mathematics.

Learning Outcomes:

(1)   use knowledge in application of mathematical eqaution in physics and engineering.

    2. solve real world math problems.

    3. Perform research in applied mathematics.

Semester VI

Course Code: SMAT6PR2	Course Title: Practical-II(Based on SMAT 603,SMAT 604)

Learning Objectives:

(a)   To make them aware about the function space of real valued continuous functions on a metric space X.

    To train them about The space with sup norm. Weierstrass approximation

    Theorem.

To help in analysis of Fourier series of functions on   , Dirichlet kernel,

(2) Determination of error term for all above methods. Convergence of numerical integration: Necessary and sufficient condition

Learning Outcomes:

1. Determine of error term for all above methods. Convergence of numerical integration: Necessary and sufficient condition

2. Solve problems on convergence of numerical integration

3.analyse fourier series

Semester VI

Course Code: SMAT6AC	Course Title: Applied Component Theory

Learning Objectives:
To train them with Object Oriented System: Information system, Purpose of system analysis and design, System Development Life Cycle.
2.To make them aware about Programming approach: Procedural and Object-Oriented approach
3. To sensitize them with **Object-Orientation:** Features of object-orientations: Abstraction, Inheritance, Encapsulation and Polymorphism. Introduction to Object- Oriented Analysis and Design.

Learning Outcomes:

1. **Solve problems on Object Oriented System:** Information system, Purpose of system analysis and design, System Development Life Cycle.
2. **Analyse Programming approach:** Procedural and Object-Oriented approach
3. **Use** Features of object-orientations: Abstraction, Inheritance, Encapsulation and Polymorphism. Introduction to Object- Oriented Analysis and Design.

Course Code: SMAT6ACPR	Course Title: Applied Component Practical

Learning Objectives:
1. To make them aware about Java program to create a Java class: (a) without instance variables and methods, (b) with instance variables and without methods, (c) without instance variables and with methods. (d) with instance variables and methods.
2. To make them aware about Java program that illustrates the concepts of one, two dimensional arrays.
3. To hel them to understand Java program that illustrates the concepts of Java class that includes (a) constructor with and without parameters. (b) Overloading methods.

Learning Outcomes:
1. Write Java program to create a Java class: (a) without instance variables and methods, (b) with instance variables and without methods, (c) without instance variables and with methods. (d) with instance variables and methods.
2. Solve problems Java program that illustrates the concepts of one, two dimension arrays.
3. Solve problems on Java program that illustrates the concepts of Java class that includes (a) constructor with and without parameters. (b) Overloading methods.