SYLLABUS

FOR

B. Sc. Sem. I & II

Program: B. Sc.

Course: Mathematics

From

Academic year

2024-25

Content

Sr. No	Semester	Course number	Course Code	Course title
1	I	CC I	MHMJ-S1P1-3CR24	Introduction to Functions of Complex Quantities
2		CC II	MHMJ-S1P2-3CR24	Differential Calculus
3		Minor I	MHMN-S1P1-2CR24	Differential Calculus and Complex Variables
4			STMN-S1P1-2CR24	Descriptive Statistics
5		MDC I	MHMDC-S1P1-4CR24	Elementary Calculus
6			MHMDC-S1P2-4CR24	Fundamentals of Mathematics
7			MHMDC-S1P3-3CR24	Descriptive Statistics-I
8		SEC I	MHSEC-S1P1-2CR24	Fundamentals of Vedic Mathematics- I
9			MHSEC-S1P2-2CR24	Coordinate Geometry- I
10			MHSEC-S1P3-2CR24	Basic Mathematics-I
11		Practical I	MHMJ-S1PR1-1CR24	Lab Course-I (Major-P1)
12			MHMJ-S1PR2-1CR24	Lab Course-I (Major-P2)
13			MHMN-S1PR1-2CR24	Lab Course-I (Minor Math)
14			STMN-S1PR1-2CR24	Lab Course-I (Minor Stat)
15			MHMDC-S1PR3-1CR24	Lab Course-I (MDC)
1	II	CC III	MHMJ-S2P1-3CR24	Matrix Theory
2		CC IV	MHMJ-S2P2-3CR24	Integral Calculus & ODE
3		Minor II	MHMN-S2P1-2CR24	Integral Calculus and Matrices
4			STMN-S2P1-2CR24	Correlation and Regression
5		MDC II	MHMDC-S2P1-4CR24	Matrices and Determinants
6			MHMDC-S2P2-4CR24	Ordinary Differential Equations
7			MHMDC-S2P3-3CR24	Descriptive Statistics-II
8		SEC II	MHSEC-S2P1-2CR24	Fundamentals of Vedic Mathematics- II
9			MHSEC-S2P2-2CR24	Coordinate Geometry- II
10			MHSEC-S2P3-2CR24	Basic Mathematics-II
11		Practical II	MHMJ-S2PR1-1CR24	Lab Course-II (Major-P1)
12			MHMJ-S2PR2-1CR24	Lab Course-II (Major-P2)
13			MHMN-S2PR1-2CR24	Lab Course-II (Minor Math)
14			STMN-S2PR1-2CR24	Lab Course-II (Minor Stat)
15			MHMDC-S2PR3-1CR24	Lab Course-II (MDC)

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

Major Course- I

COURSE TITLE: Introduction to Functions of Complex Quantities

COURSE CODE: MHMJ-S1P1-3CR24 [CREDITS - 03]

Course learning outcome		
At the end of this course, Students will be able to 1. Understand De' Moirve's theorem and its applications. 2. Use the concept of Euler's Expression and Hyperbolic functions for real arguments. 3. Study and learn to use an exponential, Circular and Hyperbolic functions for complex arguments. 4. Understand the Logarithm of complex numbers, inverse hyperbolic functions and separation of these into real and imaginary parts.		
Module 1	**De' Moivre's Theorem and Euler's Expressions**	**[15L]**
Learning Objective 1. To provide an introduction to the theories of functions of complex quantities. 2. To introduce students to the complex variable system.		
Learning Outcomes: At the end of this module the learner will be able to 1. Understand De' Moirve's theorem and its applications 2. Use the concept of Euler's Expression.		
1.1	De' Moivre's theorem and its applications	**[4L]**
1.2	Trigonometric functions for multiple arguments	**[4L]**
1.3	Euler's Expressions	**[4L]**
1.4	Evaluation of Indeterminate forms by using Euler's expressions	**[3L]**
Module 2	**Hyperbolic functions for real arguments, Exponential, Circular and Hyperbolic functions for complex quantities**	**[15L]**
Learning Objective 1. To equip students with necessary knowledge and skills to enable them handle mathematical operations.		
Learning Outcomes: At the end of this module the learner will be able to 1. Understand Hyperbolic functions for real arguments.		

2. Study and learn to use an exponential, Circular and Hyperbolic functions for complex arguments.
3. To introduce students' mathematical operations, analyses and problems involving complex variables and functions.

2.1	Hyperbolic functions for real arguments and their inverses	**[3L]**
2.2	Exponential, Circular and Hyperbolic functions for complex variables and their identities	**[3L]**
2.3	Euler's Theorem	**[3L]**
2.4	Relations between Circular and Hyperbolic functions	**[3L]**
2.5	Separation of Circular and Hyperbolic functions into real and imaginary parts	**[3L]**
Module 3	**Logarithm of Complex quantities and Inverse Circular and Inverse Hyperbolic functions**	**[15L]**

Learning Objective

1. To introduce students' mathematical operations, analyses and problems involving complex variables and functions.

Learning Outcomes:

At the end of this module the learner will be able to

1. Understand the Logarithm of complex numbers, inverse hyperbolic functions and separation of these into real and imaginary parts.

3.1	Logarithm of complex quantities	**[3L]**
3.2	Separation of logarithmic function	**[4L]**
3.3	Inverse Circular functions into real and imaginary parts.	**[4L]**
3.4	Inverse Hyperbolic functions into real and imaginary parts.	**[4L]**

References:

1. S. L. Loney: Plane Trigonometry, Part I and II, 6/e, Mc Millan and Co., London.
2. Hari Kishan: Trigonometry, Atlantic Pub., New Delhi, 2005
3. R. S. Verma, K. S. Shukla: Text book of Trigonometry, Pothishala Pvt. Ltd. Allahabad, Edition 1999.
4. B. S. Grewal: Elementary Engineering Mathematics, 9/e, Khanna Publishers, New Delhi.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Understand De' Moirve's theorem and its applications.	X	X	X			
Use the concept of Euler's Expression and Hyperbolic functions for real arguments.	X	X	X	X		
Study and learn to use an exponential, Circular and Hyperbolic functions for complex arguments.	X	X				
Understand the Logarithm of complex numbers, inverse hyperbolic functions and separation of these into real and imaginary parts.	X	X	X			

F.Y. BSc. (MATHEMATICS) SEMESTER I

COURSE TITLE: MAJOR LAB COURSE

COURSE CODE: MHMJ-S1PR1-1CR24 [Credit- 01]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Demonstrate Mathematical skills. 2. Correlate their Mathematical theory concepts through practical.

PRACTICAL Major MHMJ-S1PR1-1CR24 (Lab Course - I)	
1	Verify De' Moivre's theorem.
2	Expansion of Trigonometric functions, Finding the last term of Trigonometric functions.
3	Evaluation of Indeterminate forms by Euler's expression.
4	Examples related Hyperbolic functions and Inverse Hyperbolic functions.
5	Relation between Circular and Hyperbolic functions.
6	Application of Euler's theorem.
7	Separation into the Real and Imaginary parts of Circular functions and Hyperbolic functions.
8	Separation into the Real and Imaginary parts of Logarithm functions and Inverse Trigonometric functions.

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

Major Course- II

COURSE TITLE: Differential Calculus

COURSE CODE: MHMJ-S1P2-3CR24 [CREDITS - 03]

Course learning outcome		
At the end of this course, Students will be able to 1. Solve examples of Successive differentiation, nth derivatives, apply Leibnitz theorem in various examples. 2. Understand Rolle's and mean value theorems and apply Maclaurin and Taylor's Expansions to solve the examples. 3. Solve the examples of the curvatures, asymptotes, concavity and convexity, classify the decreasing and increasing functions.		
Module 1	**Successive Differentiation, Mean value theorems**	**[15L]**
Learning Objective 1. To understand the advance concepts and principles of Differential calculus, Mean value theorems and use of theorems.		
Learning Outcomes: At the end of this module the learner will be able to 1. Solve examples of Successive differentiation, n^{th} derivatives, apply Leibnitz theorem in various examples. 2. Understand Rolle's and mean value theorems and apply Maclaurin and Taylor's Expansions to solve the examples.		
1.1	Successive differentiation	**[3L]**
1.2	Calculation of n^{th} derivatives of some standard functions (rational functions and powers of sine, cosine functions)	**[3L]**
1.3	Leibnitz theorem and its applications	**[3L]**
1.4	Maclaurin and Taylor's Expansions	**[3L]**
1.5	Rolle's and mean value theorems	**[3L]**
Module 2	**Curvature**	**[15L]**
Learning Objective • To learn about concept of indeterminate forms, tangent and normal and curvature.		

Learning Outcomes:

At the end of this module the learner will be able to

- Understand the indeterminate forms, tangent and normal and curvature and radius of curvatures.

2.1	Indeterminate forms	**[3L]**
2.2	Tangents and normal	**[5L]**
2.3	Curvature and Radius of Curvature (except polar form)	**[7L]**
Module 3	**Increasing & Decreasing Functions**	**[15L]**

Learning Objective

- To learn about concept of Increasing and decreasing functions, asymptotes, concavity and convexity and their applications

Learning Outcomes:

At the end of this module the learner will be able to

- Solve the examples of the asymptotes, concavity and convexity, classify the decreasing and increasing functions.

3.1	Increasing and Decreasing functions	**[5L]**
3.2	Maxima and minima	**[5L]**
3.3	Asymptotes, Concavity and Convexity	**[5L]**

References:

1. Hari Kishan: Differential Calculus, Atlantic Publishers and Distributer(p) Ltd., Ed 2007
2. George A. Osborne: Differential and Integral Calculus, D. C. Heath & Co. Publishers, Chicago, Ed.1903.
3. Shanti Narayan and Dr. P.K. Mittal: Differential Calculus, 35/e, S. Chand and Co. New Delhi, 2022.
4. H. S. Dhami: Differential Calculus, New Age International publishers(p) Ltd., Ed. 1998.
5. Madhu Rani : Differential Calculus, Arise Publishers, Edition 2008.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Solve examples of Successive differentiation, nth derivatives, apply Leibnitz theorem in various examples.	X	X	X			
Understand Rolle's and mean value theorems and apply Maclaurin and Taylor's Expansions to solve the examples.	X	X	X	X		
Solve the examples of the curvatures, asymptotes, concavity and convexity, classify the decreasing and increasing functions.	X	X				

F.Y. BSc. (MATHEMATICS) SEMESTER I

COURSE TITLE: MAJOR LAB COURSE

COURSE CODE: MHMJ-S1PR2-1CR24 [Credit- 01]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Demonstrate Mathematical skills. 2. Correlate their Mathematical theory concepts through practical.

PRACTICAL Major MHMJ-S1PR2-1CR24 (Lab Course - I)	
1	Examples of Successive Differentiation
2	Application of Leibnitz theorem
3	Applications of Rolle's and mean value theorems
4	Examples of indeterminate forms, tangent, normal
5	Examples of Curvature of the curve and Radius of Curvature of the curve
6	Examples of Increasing and decreasing functions
7	Examples of maxima and minima
8	Examples of Asymptotes, Concavity and Convexity

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

Minor Course- I

COURSE TITLE: Differential Calculus and Complex Variables

COURSE CODE: MHMN-S1P1-2CR24 [CREDITS - 02]

Course learning outcome		
1. Understand Successive differentiation, nth derivatives, Understand the use and application of Leibnitz theorem. 2. Understand De' Moirve's theorem and its applications. 3. Understand Euler's Expression, Understand Hyperbolic functions for real arguments.		
Module 1	**Successive differentiation**	**[15L]**
Learning Objective This module is intended to • To understand the advance concepts and principles of Differential calculus and understand successive differentiation.		
Learning Outcomes: At the end of this module the learner will be able to • Understand Successive differentiation, nth derivatives, Understand the use and application of Leibnitz theorem.		
1.1	Successive differentiation	**[4L]**
1.2	Calculation of n^{th} derivatives of some standard functions (rational functions and powers of sine, cosine functions)	**[6L]**
1.3	Leibnitz theorem and its applications	**[5L]**
Module 2	**De' Moivre's Theorem and Euler's Expressions**	**[15L]**
Learning Objective This module is intended to • To felicitate students about the concept of De' Moivre's theorem and to establish a connection between complex numbers and trigonometric functions.		

- To introduce students to the complex variable system.

Learning Outcomes:

At the end of this module the learner will be able to

- To employ De' Moivre's theorem in a number of applications to solve numerical problems and trigonometric functions for multiple arguments.
- Use the concept of Euler's Expression and Hyperbolic functions and its inverses for real arguments.

2.1	De' Moivre's theorem and its applications	**[4L]**
2.2	Trigonometric functions for multiple arguments	**[4L]**
2.3	Euler's Expressions	**[4L]**
2.4	Evaluation of Indeterminate forms by using Euler's expressions	**[3L]**

References:

1. Hari Kishan: Differential Calculus, Atlantic Publishers and Distributer(p) Ltd., Edition 2007.
2. George A. Osborne: Differential and Integral Calculus, D. C. Heath & Co. Publishers, Chicago, Edition 1903.
3. Shanti Narayan and Dr. P.K. Mittal: Differential Calculus, 35/e, S. Chand and Co. New Delhi, 2022.
4. S. L. Loney: Plane Trigonometry, Part I and II, 6/e, McMillan and Co. London.
5. R. S. Verma, K. S. Shukla: Text book of Trigonometry, Pothishala Pvt. Ltd., Allahabad, Edition 1999.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Understand Successive differentiation, nth derivatives, Understand the use and application of Leibnitz theorem.	X	X	X			
Understand De' Moirve's theorem and its applications.	X	X	X	X		
Use the concept of Euler's Expression and Hyperbolic functions for real arguments.	X	X				

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

COURSE TITLE: MINOR LAB COURSE

COURSE CODE: MHMN-S1PR1-2CR24 [Credit- 02]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Demonstrate Mathematical skills. 2. Correlate their Mathematical theory concepts through practical.

PRACTICAL Minor (MHMN-S1PR1-2CR24) (Lab Course - Minor)	
1	Examples of Successive Differentiation.
2	Examples of Successive Differentiation of some standard functions.
3	Examples based on Leibnitz theorem.
4	Application of Leibnitz theorem.
5	Verify De' Moivre's theorem, Applications of De' Moivre's theorem.
6	Expansion of Trigonometric functions, Finding the last term of Trigonometric functions.
7	Evaluation of Indeterminate forms by Euler's expression.
8	Examples related Hyperbolic functions and Inverse Hyperbolic functions.

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

Minor Course- I

COURSE TITLE: Descriptive Statistics

COURSE CODE: STMN-S1P1-2CR24 [CREDITS - 02]

Course learning outcome		
At the end of this course, Students will be able to 1. Understand the concept of data. 2. Demonstrate a understanding of the fundamental Concepts of Descriptive statistics, including measures of Central tendency and measures of Dispersion. 3. Summarize and organize Data effectively using appropriate descriptive statistics techniques. 4. Interpret and analyze data sets accurately. 5. Apply the appropriate descriptive statistics techniques for different types of data, Such as discrete variable & continuous variables. 6. Calculate and interpret various partition values. 7. Apply critical thinking and problem-Solving skills to datasets, effectively utilizing descriptive Statistics techniques to draw meaningful conclusions.		
Module 1	**Measures of Central Tendency**	**[10L]**
Learning Objective 1. To provide introduction of the theories of statistics & application of statistics. 2. To provide details & computations of different measures of Central tendency. 3. Learn to compute different Averages.		
Learning Outcomes: At the end of this module the learner will be able to • Recognize, describe, and calculate the measures of the central tendency of data: mean, median, mode, Geometric mean and Harmonic mean. • Recognize, describe, and calculate the measures of location of data: quartiles, deciles and percentiles. • Students knowing Merits, Demerits and uses of the Measures of Central tendency.		
1.1	• Concept of data • Types of data: Quantitative data and Qualitative data, Discrete data and continuous data • Types of scales: Nominal, Ordinal, Interval and Ratio	**[1L]**
1.2	• Concept about Measure of Central tendency	**[2L]**

	• Measures of Central tendency: Mean {Arithmetic Mean (AM), Geometric Mean (GM), Harmonic mean (HM)}, Weighted mean Combined mean. • Relations between A.M, G.M & H.M • Merits, demerits and uses of the above measures of central tendency	
1.3	• Median: Definition, Merits, demerits and uses • Mode : Definition, Merits, demerits and uses	**[2L]**
1.4	Partition values : Quartiles, Deciles & Percentiles	**[1L]**
1.5	• Characteristics of an ideal measure of central tendency • Limitations of measures of central tendency	**[1L]**
1.6	Numerical Problems.	**[3L]**
Module 2	**Measures of Dispersion & Moments, Skewness & Kurtosis**	**[20L]**

Learning Objective

1. To introduce students to the Measures of Dispersion.
2. Gain knowledge of Relative measure & Absolute Measure.
3. Comparison of two data set by using Coefficient of Variations.
4. Describe the concepts of Moments and skewness;
5. Explain the different measures of skewness;
6. Describe the concepts of kurtosis;
7. Explain the different measures of kurtosis;
8. Explain how skewness and kurtosis describe the shape of a distribution.

Learning Outcomes:

At the end of this module the learner will be able to

- Know the limitation of measure of central tendency
- Recognize, describe, and calculate the measures of the dispersion of data: standard deviation, mean deviation about mean, quartile deviation and range.
- Know the complementary relationship of skewness with measures of central tendency and dispersion in describing a set of data.
- Understand 'moments' as a convenient and unifying method for summarizing several descriptive statistical measures

2.1	• Concept about Measure of Dispersion • Characteristics of the ideal measures of dispersion.	**[2L]**
2.2	• Relative & Absolute measures of dispersion: {Range, Quartile deviation, Mean deviation, Standard Deviation}, Variance, Combined variance & Coefficient of Variation (CV),	**[4L]**

	• Merits & demerits and uses of the above measures of dispersion	
2.3	Relationship between Quartile deviation, Mean deviation, Standard Deviation	**[1L]**
2.4	Moments: • Purpose of moments • Raw moments, Central moments, Moments about arbitrary value and relation moments, • Coefficients based on moments (β_1, β_2, γ_1, γ_2) and interpretation of various values of β_1, β_2, γ_1, γ_2 .	**[3L]**
	Skewness: • Meaning of skewness, • Types of skewness, • Methods of determining skewness and the coefficient of skewness: (i) Karl Pearson's coefficient of skewness, (ii) Bowley's coefficient of skewness (iii) skewness based on the moments.	**[3L]**
	Kurtosis: • Types of Kurtosis curves, • Measures of Kurtosis.	**[1L]**
2.5	Numerical Problems	**[6L]**

References:

1. A. M. Gun, M. K. Gupta & B. Dasgupta: Fundamentals of Statistics (Volume One) - World Press Private Ltd (1 August 2013)
2. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, 12/e, Sultan Chand and Sons;
3. Barbara Illowsky, Openstax, Susan Dean: Introductory Statistics - Open Stax Textbooks (23 March 2022)
4. Neil Weiss: Introductory Statistics – 10/e, Pearson;
5. Marvin E Johnson: Basic Statistics - Independently Published; Illustrated Edi. (11 July 2020)
6. Prem S. Mann: Introductory Statistics – 10/e, John Wiley & Sons Inc;
7. Roxy Peck, Chris Olsen, Jay L. Devore: Introduction to Statistics and Data Analysis – 5/e, Cengage Leaning.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Understand the concept of data.	X	X				
Demonstrate a understanding of the fundamental Concepts of Descriptive statistics, Including measures of Central tendency and measures of Dispersion.	X	X				
Summarize and organize Data effectively using appropriate descriptive statistics techniques.	X	X	X			
Interpret and analyze data sets accurately.				X	X	
Apply the appropriate descriptive statistics techniques for different types of data, Such as discrete variable & continuous variables.	X	X	X			
Calculate and interpret various partition values.	X	X	X			
Apply critical thinking and problem-Solving skills to datasets, effectively utilizing descriptive Statistics techniques to draw meaningful conclusions.		X	X	X		

F.Y. BSc. (MATHEMATICS) SEMESTER I

COURSE TITLE: MINOR LAB COURSE (Statistics)

COURSE CODE: STMN-S1PR1-2CR24 [Credit- 02]

Course Learning Outcomes
After the successful completion of the Course, the learner will be able to: • Students will be able to draw the descriptive statistics for the data and interpret the data • Learn how to calculate measures of central tendency and measures of dispersion

PRACTICAL Minor (STMN-S1PR1-2CR24) (Lab Course - Minor)	
1	Calculation of Arithmetic Mean, Geometric mean and Harmonic mean for the simple series, discrete frequency distribution & continuous frequency distribution
2	Calculation of Median for the simple series, discrete frequency distribution & continuous frequency distribution
3	Calculation of Mode for the simple series, discrete frequency distribution & continuous frequency distribution
4	Calculation of quartiles, deciles and percentiles for simple series, Discrete frequency distribution, Continuous frequency distribution.
5	Finding missing frequency for discrete frequency distribution & continuous frequency distribution
6	Calculation of Combine Mean and Weighted Mean
7	Calculation of range, relative measure of range, quartile deviation, coefficient of quartile deviation
8	Calculation of Mean deviation, coefficient of mean deviation
9	Calculation of variance & standard deviation
10	Comparison of two series with the use of coefficient of variation.
11	Calculation of Raw Moments, Central Moments and moments about arbitrary value,
12	Coefficient of skewness and Kurtosis for a simple series, discrete frequency distribution & continuous frequency distribution
13	Calculation of Karl pearson's coefficient of skewness
14	Calculation of Bowley's coefficient of skewness.

Minimum number of experiments: 11

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

Multidisciplinary Course

COURSE TITLE: Elementary Calculus

COURSE CODE: MHMDC-S1P1-4CR24 [CREDITS - 04]

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Understand Cartesian product of sets, real valued function and different types of functions. 2. Understand the concept of limit and differentiability & continuity of functions. 3. Understand the concept of derivatives and solve examples of differentiation. 4. Understand integration and solve finite & definite integration by various method.		
Module 1	**Real valued functions**	**[15L]**
Learning objectives: The module is intended to • Develop the basic idea of Cartesian product, ordered pairs and relation. • Give knowledge of Real valued functions and different types of functions and its operations.		
Learning outcomes: After the successful completion of the module, the learner will be able to • Understand Cartesian product of sets, real valued function and different types of functions • Understand product and quotients of functions.		
1.1	Ordered pairs, Cartesian product of sets. Number of elements in the Cartesian product of two finite sets. Cartesian product of the reals with itself (up to R×R×R).	[4L]
1.2	Definition of relation, pictorial diagrams, domain, co-domain and range of a relation. Function as a special kind of relation from one set to another	[3L]

1.3	Pictorial representation of a function, domain, co-domain and range of a function. Real valued functions, domain and range of these functions.	[3L]
1.4	constant, identity, polynomial, rational. Sum, difference, product and quotients of functions	[4L]
Module 2	**Limit and Continuity of function**	**[15L]**
Learning objectives: This module is intended to ● Give deep knowledge of Limit and Continuity of function ● Enhance the skill of solving problems using rules of Limit.		
Learning outcome: After the successful completion of the module, the learner will be able to ● Understand the concept of limit and differentiability & continuity of functions.		
2.1	Basic concept of a limit of a function, Rules of limits.	[5L]
2.2	Infinite limits and limits at infinity, Continuity and types of discontinuities.	[5L]
2.3	Differentiability of a function.	[5L]
Module 3	**Differentiation**	**[15L]**
Learning objectives: This module is intended to ● Develop the concept of differentiation of different types of functions.		
Learning outcome: After the successful completion of the module, the learner will be able to ● Understand the concept of derivatives and solve examples of differentiation.		
3.1	Derivative of composite functions, Chain rule, Derivatives of trigonometric functions.	[5L]

3.2	Derivative of implicit function, Concepts of exponential, Logarithmic functions	[5L]
3.3	Derivatives of $\log_e x$ and e^x by definition of differentiation.	[5L]
Module 4	**Integration**	**[15L]**
Learning objectives: This module is intended to • Develop the concept of integration of different types of functions by various methods.		
Learning outcome: After the successful completion of the module, the learner will be able to • Understand integration and solve finite & definite integration by various method.		
4.1	Integration as an inverse process of differentiation, Definite integrals.	[5L]
4.2	Integration of some functions by substitution, integration by partial fractions	[5L]
4.3	Integration by parts, Finite integral.	[5L]

References:

1. Tom M. Apostol: Calculus, Volume I and II, 2/e, John Wiley & Sons Inc., New York.
2. Serge Lang: Basic Mathematics, 1/e, Addison -Wesley Publishing Company, 1971.
3. Shanti Narayan and Dr. P.K. Mittal: Differential Calculus, 35/e, S. Chand and Co. New Delhi, 2022
4. Jain and Iyengar: Advanced Engineering Mathematics, 4/e, Narosa Publishing House

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Understand Cartesian product of sets, real valued function and different types of functions.	X					
Understand the concept of limit and differentiability & continuity of functions.	X	X	X			
Understand the concept of derivatives and solve examples of differentiation.	X	X			X	
Understand integration and solve finite & definite integration by various method.	X		X		X	

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

Multidisciplinary Course

COURSE TITLE: Fundamentals of Mathematics

COURSE CODE: MHMDC-S1P2-4CR24 [CREDITS - 04]

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Understand various number including complex numbers and linear inequalities. 2. Understand the concept of sets, principle mathematical induction and its application. 3. Understand linear equations and solve equations of two variables by various methods. 4. Understand the concept of co-ordinate geometry, graphical method to solve linear equations and concept of function including different type of functions.		
Module 1	**Numbers**	**[15L]**
Learning objectives: The module is intended to • Develop the basic idea of different types of numbers including complex numbers.		
Learning outcomes: After the successful completion of the module, the learner will be able to • Understand various number including complex numbers and linear inequalities.		
1.1	Whole numbers, Integers, Fractions, Exponents and radicals.	[5L]
1.2	Complex Numbers, Arithmetic operations on complex numbers,	[5L]
1.3	Absolute Value, Interval notation and linear inequalities.	[5L]
Module 2	**Sets**	**[15L]**
Learning objectives: This module is intended to • Give idea of sets, Mathematical inductions and its applications		

Learning outcome: After the successful completion of the module, the learner will be able to • Understand the concept of sets, principle mathematical induction and its application.		
2.1	Sets, Intervals, Boundedness of sets, Supremum and Infimum, and Countable and uncountable sets.	[5L]
2.2	Process of the proof by mathematical induction, application of the method by looking at natural numbers as the least inductive subset of real numbers	[5L]
2.3	The principle of mathematical induction (weak and strong) and simple applications.	[5L]
Module 3	**System of Linear equations**	**[15L]**
Learning objectives: This module is intended to • Give knowledge of fundamental of mathematics which gives idea of various methods to solve equations.		
Learning outcome: After the successful completion of the module, the learner will be able to • Understand linear equations and solve equations of two variables by various methods.		
3.1	Linear equation in two variables, Solution of simultaneous linear equations in two variables – Method of substitution.	[5L]
3.2	Cramer's Rule, Elimination method, Cross multiplication	[5L]
3.3	Quadratic equations, methods to solve quadratic equations.	[5L]
Module 4	**Geometry and Functions**	**[15L]**
Learning objectives: This module is intended to • Develop understanding of geometry and various functions in Mathematics.		
Learning outcome:		

After the successful completion of the module, the learner will be able to • Understand the concept of co-ordinate geometry, graphical method to solve linear equations and concept of function including different type of functions.		
4.1	Coordinate plane, points, distance, midpoint, lines	[5L]
4.2	Graphical method to solve system of linear equation and linear inequalities.	[5L]
4.3	Introduction to functions, Polynomial functions, Graphs of functions, Exponential function, Logarithms.	[5L]

References:

1. Serge Lang: Basic Mathematics, 1/e, Addison -Wesley Publishing Company, 1971.
2. S.C. Malik and Savita Arora, Mathematical Analysis, 2/e, New Age International (P) Limited, New Delhi, India, 1994.
3. Colin McGregor, Jonathan Nimmo, Wilson Stothers: Fundamentals of University Mathematics, 3/e, Woodhead Publishing, 1994.
4. Sanjay Mishra : Fundamentals of Mathematics : Functions and Graphs, 2/e, Pearson, 2016.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Understand various number including complex numbers and linear inequalities.	X					
Understand the concept of sets, principle mathematical induction and its application.	X	X				
Understand linear equations and solve equations of two variables by various methods.	X	X			X	
Understand the concept of co-ordinate geometry, graphical method to solve linear equations and concept of function including different type of functions.	X		X			

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

Multidisciplinary Course

COURSE TITLE: Descriptive Statistics-I

COURSE CODE: MHMDC-S1P3-3CR24 [CREDITS - 03]

Course learning outcome		
At the end of this course, Students will be able to 1. Distinguish between different types of data. 2. Collect, classify and tabulate a given data and study graphical and diagrammatic representations through Bar diagrams, Pie diagram, Histogram, Frequency polygon 3. Understand measures of central tendency, viz., Mean, Median, Mode etc. 4. Workout simple problems in discrete and continuous series. 5. Draw meaningful conclusions from a set of data.		
Module 1	**Collection, classification and tabulation of data**	**[10L]**
Learning Objective 1. Students will understand the meaning and purpose of data collection. 2. Students will learn about classification of data for further statistical analysis 3. Students will learn about tabulation of the data.		
Learning Outcomes: At the end of this module the learner will be able to 1. Collect, classify and tabulate a given data		
1	➢ Concept and Types of Data: ▪ Qualitative and quantitative data, Discrete and continuous data, ➢ Collection of data: ▪ Primary data and Secondary data, ➢ Classification of data: ▪ Meaning, and Types of classification, ➢ Tabulation of data: ▪ Meaning and Types of tables, ▪ Univariate frequency distribution: Discrete and continuous frequency distribution, Cumulative frequency distribution, ▪ Bivariate frequency distribution: Discrete and continuous bivariate frequency distribution, marginal and conditional frequency distribution.	**[10L]**
Module 2	**Diagrammatic and graphic presentation of data**	**[08L]**
Learning Objective 1. Learn importance of diagrammatic presentation of data. 2. Construct and interpret different types of diagrams and graphs.		

Learning Outcomes: At the end of this module the learner will be able to 1. Learn how to visualize data.		
2	➢ Diagrams: ▪ Introduction and Types of diagrams: o Line diagrams, Bar diagrams (simple, multiple, sub-divided and percentage-divided), Box plot and Pie diagram ➢ Graphs: ▪ Introduction of Graphs: ▪ Graphs of frequency distributions: Histogram, Frequency polygon, Frequency curve, Cumulative frequency polygon, Cumulative frequency curve.	**[08L]**
Module 3	**Measures of central tendency**	**[12L]**
Learning Objective 1. To provide details & computations of different measures of Central tendency. **2.** Distinguish between different types of averages.		
Learning Outcomes: At the end of this module the learner will be able to 1. Understand measures of central tendency, viz., Mean, Median and Mode in series of individual observations and Discrete or Continuous series. 2. Recognize, describe, and calculate the measures of location of data: quartiles and percentiles. 3. Draw meaningful conclusions from a set of data.		
3	➢ Concept of measures of central tendency, Requisites of good measures of central tendency, ➢ Measures of central tendency: Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, and Mode ➢ Partition values: Quartiles and Percentiles, ➢ Empirical relationship between mean, median and mode.	**[12L]**

References:

1. A. M. Gun, M. K. Gupta & B. Dasgupta: Fundamentals of Statistics (Volume One) - World Press Private Ltd (1 August 2013)
2. Barbara Illowsky, Openstax, Susan Dean: Introductory Statistics - Open Stax Textbooks (23 March 2022)
3. Neil Weiss: Introductory Statistics – 10/e, Pearson;
4. Marvin E Johnson: Basic Statistics - Independently Published; Illustrated Edi. (11 July 2020)
5. Prem S. Mann: Introductory Statistics – 10/e, John Wiley & Sons Inc;
6. Roxy Peck, Chris Olsen, Jay L. Devore: Introduction to Statistics and Data Analysis – 5/e, Cengage Leaning.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Distinguish between different types of data.		X				
Collect, classify and tabulate a given data and study graphical and diagrammatic representations through Bar diagrams, Pie diagram, Histogram, Frequency polygon	X			X		X
Understand measures of central tendency, viz., Mean, Median, Mode etc.	X	X	X			X
Workout simple problems in discrete and continuous series.	X			X	X	X
Draw meaningful conclusions from a set of data.	X				X	X

F.Y. BSc. (MATHEMATICS) SEMESTER I

COURSE TITLE: MDC LAB COURSE

COURSE CODE: MHMDC-S1PR3-1CR24 [Credit- 01]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Demonstrate Mathematical skills. 2. Correlate their Statistical theory concepts through practical.

PRACTICAL (MHMDC-S1PR3-1CR24) (Lab Course - MDC)	
1	Construction of desecrate / continuous / cumulative frequency distribution
2	Construction of Bivariate frequency table
3	Create simple / multiple / sub-divided / percentage-divided bar diagram
4	Create Pie chart
5	Create Box Plot chart
6	Construct Histogram, frequency polygon and frequency curve
7	Obtain Median, Quartiles, percentile and Mode from the graph
8	Calculation of arithmetic mean, geometric mean and Harmonic mean and their relationship for the simple series / discrete frequency distribution / continuous frequency distribution.
9	Calculation of Median and Mode for the simple series / discrete frequency distribution / continuous frequency distribution.
10	Calculation of Quartiles and percentiles for the simple series / discrete frequency distribution / continuous frequency distribution.

Minimum number of experiments: 09

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

Skill Enhancement Course- I

COURSE TITLE: Fundamentals of Vedic Mathematics- I

COURSE CODE: MHSEC-S1P1-2CR24 [CREDITS - 02]

Course learning outcome		
At the end of this course, Students will be able to 1. Develop the understanding of objectives and features of Vedic maths. 2. Recognize the meaning of mathematical sutras in Sanskrit. 3. Understand the concept of addition and subtraction using completing the whole andfrom left to right. 4. Manage to solve the multiplication using vertically and crosswise and one more than the previous one method and demonstrate multiplication by 11, 12 and 13 by using Vedic sutras of multiplication.		
Module 1	**History**	**[15L]**
Learning Objective 1. Understand the historical and cultural significance of Vedic Mathematics. 2. Apply Vedic Mathematics techniques to perform rapid and accurate calculations mentally.		
Learning Outcomes: At the end of this module the learner will be able to 1. Develop the understanding of objectives and features of Vedic maths. 2. Recognize the meaning of mathematical sutras in Sanskrit.		
1.1	History of Vedic maths, why Vedic maths, salient features of Vedic maths	**[3L]**
1.2	Vedic maths formulas, 16 sutras, 13 sub sutras, terms and operations	**[4L]**
1.3	High speed addition by using the concept of computing the whole and from left to right	**[4L]**

1.4	Superfast subtraction by Nikhilam Sutram from basis 100, 1000, 10000.	**[3L]**
Module 2	**Addition, Subtraction and Multiplication**	**[15L]**

Learning Objective

1. Solve arithmetic problems using Vedic sutras for addition, subtraction, multiplication, and division.

Learning Outcomes:

At the end of this module the learner will be able to

1. Understand the concept of addition and subtraction using completing the whole andfrom left to right.
2. Manage to solve the multiplication using vertically and crosswise and one more than the previous one method and demonstrate multiplication by 11, 12 and 13 by using Vedic sutras of multiplication.

2.1	Multiplication by Urdhavtrighbhyam sutram, multiplication by Vinculum sutram	**[1L]**
2.2	Multiplication by Nikhilam sutram, fast multiplication by 11	**[2L]**
2.3	Multiplication of numbers consisting of all 9s	**[3L]**
2.4	Multiplication of numbers nearest to the base 10	**[1L]**
2.5	Multiplication of numbers with sub base 50, 500, 5000.	**[3L]**

References:

1. Sri Bharatikrishna Tirthaji: Vedic Mathematics, 17/e, Published by Motilal Banarsidass, 1965.
2. Williams K.R.: Discover Vedic Mathematics, Vedic Mathematics Research Group, 1984. (Revised edition)
3. Wiliams K.R. and M. Gaskell: The Cosmic Calculator, 1/e, Motilal Banarsidass, 2002. (Revised 2005)
4. Nicholas A. P., Williams, J. Pickles: Vertically and Crosswise, 2/e, Inspiration books, 1984.
5. Kenneth R. Williams: Vedic Mathematics- Teacher's manual. (Elementary and Advanced level), 1/e, Inspiration books, 2002, (Revised 2009).
6. Vandana Singhal: Vedic Mathematics for all ages-A beginner's guide, 2/e, Motilal Banarsidass Publishers, 2014.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Develop the understanding of objectives and features of Vedic maths.	X	X	X			
Recognize the meaning of mathematical sutras in Sanskrit.	X	X	X	X		
Understand the concept of addition and subtraction using completing the whole and from left to right.	X	X				
Manage to solve the multiplication using vertically and crosswise and one more than the previous one method and demonstrate multiplication by 11, 12 and 13 by using Vedic sutras of multiplication.	X	X	X	X		

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

Skill Enhancement Course- I

COURSE TITLE: Coordinate Geometry- I

COURSE CODE: MHSEC-S1P2-2CR24 [CREDITS - 02]

Course learning outcome		
At the end of this course, Students will be able to 1. Understand the principles of Cartesian coordinates and their applications. 2. Analyse and manipulate equations of straight lines and circles. 3. Explore the properties and equations of conic sections. 4. Apply transformation techniques to geometric objects. 5. Solve real-world problems using coordinate geometry methods.		
Module 1	**Cartesian Coordinates and Lines**	**[15L]**
Learning Objective 1. Apply various forms of equations of lines (slope-intercept, point-slope, intercept) effectively. 2. Identify and analyse relationships between parallel and perpendicular lines. 3. Utilize distance and midpoint formulas to solve geometric problems.		
Learning Outcomes: At the end of this module the learner will be able to 1. Understand the slope and intercept forms of straight lines. 2. Analyse parallel and perpendicular lines. 3. Solve problems involving distance and midpoint formulae.		
1.1	Introduction to Cartesian Coordinates	**[1L]**
1.2	Equations of Lines • Slope-intercept form • Point-slope form • Intercept form	**[3L]**
1.3	Parallel and Perpendicular Lines	**[2L]**
1.4	Distance and Midpoint Formulae	**[3L]**

1.5	Applications of Lines in Two Dimensions	**[3L]**
1.6	Problem-Solving Exercises	**[3L]**
Module 2	**Circles, Conic Sections and Transformations**	**[15L]**

Learning Objective

1. Apply transformation techniques (translation, rotation, reflection, dilation) accurately to geometric objects.
2. Analyse real-world situations using coordinate geometry techniques effectively, such as modelling orbits or designing structures.

Learning Outcomes:

At the end of this module the learner will be able to

1. Describe the properties and equations of circles.
2. Understand the characteristics of conic sections (ellipse, hyperbola, parabola).
3. Solve problems involving circles, conic sections, and transformations.

2.1	Equations of Circles	**[1L]**
2.2	Properties of Circles	**[2L]**
2.3	Conic Sections: Ellipse, Hyperbola, Parabola	**[3L]**
2.4	Introduction to Transformations	**[1L]**
2.5	Translation and Reflection	**[3L]**
2.6	Rotation and Dilation	**[2L]**
2.7	Applications of Circles, Conic Sections, and Transformations	**[2L]**
2.8	Real-World Problem Solving	**[1L]**

References:

1. S.L. Loney: Coordinate Geometry, 13/e, Arihant Prakashan, 2017.
2. Henry Burchard Fine & Henry Dallas Thompson: Coordinate Geometry, The Macmillan Comp., N.Y., Edition 1911.
3. P. R. Vittal: Analytical Geometry 2D & 3D, 1/e, Pearson, 2013.
4. S.K. Sharma: Introduction to Coordinate Geometry
5. R. S. Aggarwal: Coordinate Geometry, S. Chand Publishers.
6. Mishra Sanjay: Fundamentals of Mathematics- Coordinate Geometry, 2/e, Pearson, 2015.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Understand the principles of Cartesian coordinates and their applications.	X	X				
Analyse and manipulate equations of straight lines and circles.	X	X	X			
Explore the properties and equations of conic sections.	X	X				
Apply transformation techniques to geometric objects.		X	X	X		
Solve real-world problems using coordinate geometry methods.			X	X	X	X

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

Skill Enhancement Course- I

COURSE TITLE: Basic Mathematics- I

COURSE CODE: MHSEC-S2P3-2CR24 [CREDITS - 02]

Course learning outcome		
After the successful completion of the Course, the learner will be able to: 1. Study basic about mathematics to explore concepts and basic mathematics. 2. Develop and enhanced Mathematical Skills after studying mathematical fundamental concepts. 3. Understand the basic concept of sets and relations. 4. Understand concept of function including different type of functions.		
Module 1	**Set theory and relations**	**[15L]**
Learning objectives: The module is intended to • Understand the basic concept of sets and relations.		
Learning outcomes: After the successful completion of the module, the learner will be able to • Study basic about mathematics to explore concepts and basic mathematics.		
1.1	Set theory : Introduction, representation operations and their properties	[4L]
1.2	Venn diagram, Cartesian product and graphs	[3L]
1.3	Relations as sets of ordered pairs and types of relations	[3L]
1.4	Properties of relations	[2L]
1.5	Equivalent classes and composition of relations	[3L]
Module 2	**Functions**	**[15L]**
Learning objectives: This module is intended to Understand concept of function including different type of functions.		

Learning outcome:

After the successful completion of the module, the learner will be able to

- Develop and enhanced mathematical skills after studying mathematical fundamental concepts.

2.1	Definition of functions, types of domain and range	[3L]
2.2	Construction and functions	[3L]
2.3	Types of Functions (Linear, Quadratic, Polynomial)	[3L]
2.4	Composition of two functions	[3L]
2.5	Inverse functions, Characteristics functions	[3L]

References:

1. Serge Lang: Basic Mathematics, 1/e, Springer Nature B.V., US, 1998.
2. Behnke H. & at al: Fundamental of Mathematics-Volume-1, The MIT Press Cambridge. 1986. (Third Printing)
3. Sanjay Mishra: Fundamentals of Mathematics: Functions and Graphs, 2/e, Pearson, 2016.
4. Qazi Zameeruddin, V. K. Khanna and S.K. Bhambri: Business Mathematics, 2/e, Vikas Publishing House Pvt. Ltd., 2006.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Study basic about mathematics to explore concepts and basic mathematics.	X	X				
Develop and enhanced Mathematical Skills after studying mathematical fundamental concepts.	X	X		X		
Understand the basic concept of sets and relations.	X	X			X	
Understand concept of function including different type of functions.	X		X			