SYLLABUS

FOR

B. Sc. Sem. I & II

Program: B. Sc.

Course: Mathematics

From

Academic year

2024-25

Board of studies in Mathematics

Undergraduate and Post graduate

	Name	Designation	Institute/Industry
Head of the Department			
1	Dr. Khagenrai Chauhan	Chairman	Sir. P. T. Sarvajanik College of Science, Surat.
All Faculty Members of the Department			
1	Dr. Janki Vashi	Adhyapak Sahayak	Sir. P. T. Sarvajanik College of Science, Surat.
2	Dr. Jaimikaben Surawala	Adhyapak Sahayak	Sir. P. T. Sarvajanik College of Science, Surat.
Two Subject expert from the Parent University are to be nominated by Academic Council			
1	Prof. Subhash Krishnan	Head & Associate Professor	K.J. Somaiya College of Science and Commerce, Mumbai. ((Autonomous)
2	Dr. Udayan Prajapati	Head & Associate Professor	St. Xavier's College, Ahmedabad. (Autonomous)
One subject expert is to be nominated by Vice-Chancellor form a panel of six recommended by the Autonomous College Principal			
1	Dr. Kasuhal Patel	Associate Professor	Department of Mathematics, Veer Narmad South Gujarat University, Surat.
One representative from Industry/ Corporate Sector/ allied areas to be nominated by Principal			
1	Mr. Dharmesh Patel	Officer	Canara Bank, Surat.
One Alumnus to be nominated by Principal			
1	Dr. Chhaya Desai	Assistant Professor	Department of Mathematics, Dr. S. S. Gandhi Engineering College, Surat.
Experts from outside the Autonomous College, whenever special courses of studies are to be formulated, to be nominated by the Principal.			
1	Dr. Jatin Desai	Retd. Associate Professor	Sir. P. T. Sarvajanik College of Science, Surat.

Graduate Attributes

After the successful completion of modules in different courses of B.Sc. MATHEMATICS, the learner will be able to:

GA 1: Apply concepts of Mathematics and acquired skill sets to unknown problems in order to establish an effective approach or strategy for dealing with them.

GA 2: Explore and derive quantitative data in the realms of Mathematics.

GA 3: Develop analytical and observation skills through different examples.

GA 4: Approach any real life problem with proper assumption, logic and constraints.

GA 5: Prepare for jobs, career development, and lifelong learning in Mathematics, by using acquired ICT skills and mathematical skills.

Programme Specific Outcomes

PSO - 1 Derive a solution by the use of Definition.

PSO - 2 Use of theorems to solve problems under the given scenario.

PSO - 3 For the solution of Difficult examples usage of abstract knowledge.

PSO - 4 Generalise results for a general set up.

PSO - 5 For problem solving generation of ideas.

PSO - 6 create meritorious students by gained knowledge.

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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)

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Detailed Syllabus

B. Sc. Mathematics

(With effect from the Academic year 2024-25)

Course No.	Course Title	Course Code	Credits	Hours	Module	Lectures per module (1 Hr)	Internal Marks	External Marks	Total Marks
							Examination		
SEMESTER I									
Major Courses THEORY									
I	Introduction to Functions of Complex Quantities	MHMJ-S1P1-3CR24	3	45	3	15	50	50	100
II	Differential calculus	MHMJ-S1P2-3CR24	3	45	3	15	50	50	100
Minor Course THEORY									
I	Differential Calculus and Complex Variables	MHMN-S1P1-2CR24	2	30	2	15	50	50	100
I	Descriptive Statistics	STMN-S1P1-2CR24	2	30	2	15	50	50	100
Multidisciplinary Courses									
I	Elementary Calculus	MHMDC-S1P1-4CR24	4	60	4	15	50	50	100
II	Fundamentals of Mathematics	MHMDC-S1P2-4CR24	4	60	4	15	50	50	100
III	Descriptive Statistics-I	MHMDC-S1P3-3CR24	3	45	3	15	50	50	100
Skill Enhance Course (SEC)									
I	Fundamentals of Vedic Mathematics- I	MHSEC-S1P1-2CR24	2	30	2	15	25	25	50
II	Coordinate Geometry- I	MHSEC-S1P2-2CR24	2	30	2	15	25	25	50
III	Basic Mathematics-I	MHSEC-S1P3-2CR24	2	30	2	15	25	25	50
Major Courses Practical									
I	Lab Course-I	MHMJ-S1PR1-1CR24	1	30					25
II	Lab Course-I	MHMJ-S1PR2-1CR24	1	30					25
Minor Courses Practical									
I	Minor Lab Course-I	MHMN-S1PR1-2CR24	2	30					50
I	Minor Lab Course-I	STMN-S1PR1-2CR24	2	30					50

	Multidisciplinary Courses Practical								
I	Multidisciplinary Lab Course-I	MHMDC-S1PR3-1CR24	1	15	1	15			25

SEMESTER II

	Major courses THEORY								
I	Matrix Theory	MHMJ-S2P1-3CR24	3	45	3	15	50	50	100
II	Integral Calculus & ODE	MHMJ-S2P2-3CR24	3	45	3	15	50	50	100
	Minor Course THEORY								
I	Integral Calculus and Matrices	MHMN-S2P1-2CR24	4	60	4	15	50	50	100
I	Correlation and Regression	STMN-S2P1-2CR24	2	30	2	15	50	50	100
	Multidisciplinary Courses								
I	Matrices and Determinants	MHMDC-S2P1-4CR24	4	60	4	15	50	50	100
II	Ordinary Differential Equations	MHMDC-S2P2-4CR24	4	60	4	15	50	50	100
III	Descriptive Statistics-II	MHMDC-S2P3-3CR24	3	45	3	15	50	50	100
	Skill Enhance Course (SEC)								
I	Fundamentals of Vedic Mathematics- II	MHSEC-S2P1-2CR24	2	30	2	15	25	25	50
II	Coordinate Geometry- II	MHSEC-S2P2-2CR24	2	30	2	15	25	25	50
III	Basic Mathematics-II	MHSEC-S2P3-2CR24	2	30	2	15	25	25	50
	Major Courses Practical								
I	Lab Course-II	MHMJ-S2PR1-1CR24	1	30					25
II	Lab Course-II	MHMJ-S2PR2-1CR24	1	30					25
	Minor Courses Practical								
I	Minor Lab Course-II	MHMN-S2PR1-2CR24	2	30					50
I	Minor Lab Course-II	STMN-S2PR1-2CR24	2	30					50
	Multidisciplinary Courses Practical								
I	Multidisciplinary Lab Course-II	MHMDC-S2PR3-1CR24	1	15					25

ACKNOWLEDGEMENT

I express my heartfelt gratitude to our dynamic Principal, Dr. Pruthul R. Desai, for his invaluable guidance and unwavering support throughout the curriculum restructuring process.

I would also like to express my sincere appreciation to the esteemed members of the Board of Studies. Their constructive suggestions and valuable contributions.

Above all, I am profoundly thankful to my dedicated colleagues in the Department, who tirelessly worked on compiling the syllabus.

Dr. Khagenrai J. Chauhan

Chairperson,

Board of Studies in Mathematics.

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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			

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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 nth 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, Increasing & Decreasing Functions**	**[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	**Curvature, 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 curvatures, 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

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

Minor Course- I

COURSE TITLE: Differential Calculus and Complex Variables

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

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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 nth 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	[1L]
	• Types of data: Quantitative data and Qualitative data, Discrete data and continuous data	
	• Types of scales: Nominal, Ordinal, Interval and Ratio	
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

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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	

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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	Obtain Range, Coefficient of range, Quartile deviation and Coefficient of Quartile deviation.
2	Obtain standard deviation, coefficient of standard deviation and variance.
3	Comparison of two series using coefficient variation.
4	Example of probability based on geometric series.
5	Example of probability.
6	Calculation of Karl Pearson's correlation coefficient.
7	Calculation of spearman's Rank correlation coefficient.
8	Calculation of Karl Pearson's correlation coefficient for a bivariate frequency table.
9	Obtain both regressions lines.
10	Estimate the value of dependent variable for a given value of independent variable from an appropriate regression line
11	Calculate the coefficient of determination and interpret it.

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		

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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			

Semester II

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

Major Course- III

COURSE TITLE: Matrix Theory

COURSE CODE: MHMJ-S2P1-3CR24   [CREDITS - 03]

Course learning outcome

At the end of this course, Students will be able to

1. Understand the concept of matrices and types of matrices, operations on matrices.

2. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, compute rank of a matrix and inverse of matrix by elementary row operations and Quadratic form.

3. Find trace of matrix and its properties and solve the system of homogeneous and non-homogeneous linear equation by row-reduced echelon form.

4. Calculate eigenvalues and corresponding eigenvectors for a square matrix and apply Cayley- Hamilton theorem to find inverse of a matrix and understand method of diagonalization.

Module 1	Some special types and operations on matrices & Row reduced Echelon form	[15L]

Learning Objective

This module is intended to

- Understand the use of some special types of matrices and to implement procedures of different properties of addition, subtraction, multiplication and scalar multiplication on matrices.

- Study Row Elementary operations on matrices and to obtain inverse of matrix.

Learning Outcomes:

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

- Understand the concept of matrices and some special types of matrices and operations on matrices.

- Apply row reduced echelon form to find the inverse of a Matrix.

1.1	Introduction of various types of Matrices, Definitions and illustrations.	[1L]
1.2	Operations on Matrices	[2L]
1.3	Properties of operations of Matrices	[2L]
1.4	Elementary row operations.	[3L]
1.5	Row-reduced Echelon form	[3L]
1.6	Inverse of matrix by Row–reduced Echelon form	[4L]
Module 2	**Rank of Matrix and Homogeneous & non-homogeneous system of linear equations**	**[15L]**

Learning Objective

This module is intended to

- Understand how to compute Row rank of a matrix and Quadratic form.

- Study trace of matrix with its properties and to solve the system of linear equation

    by Elementary row operations

Learning Outcomes:

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

- Apply the concept of trace of matrix and its properties to solve the examples of Matrices.

- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank and inverse of matrix by Elementary row operations and Quadratic form.

2.1	Row rank of a matrix	[3L]
2.2	Quadratic form	[4L]
2.3	Trace of matrix and its properties	[3L]
2.4	Solution of homogeneous and non-homogeneous system of linear equations using Row–reduced Echelon form.	[5L]

Module 3	Eigen values and Eigen vectors	[15L]
Learning objectives: This module is intended to ● Study the basic concepts of eigenvalues and corresponding eigenvectors for a square matrix and use of Cayley- Hamilton theorem to find inverse of a matrix. ● Introduce to apply method of diagonalization.		
Learning outcome: After the successful completion of the module, the learner will be able to ● Compute eigenvalues and corresponding eigenvectors for a square matrix ● Understand the use of method to find Characteristic equation using determinant and minors of a matrix ● Apply Cayley- Hamilton theorem and find inverse of a matrix using Cayley-Hamilton theorem. ● Apply Method of diagonalization on matrix.		
3.1	Characteristic equation of a matrix	[2L]
3.2	Method to find Characteristic equation using determinant and minors of a matrix	[3L]
3.3	Eigen values and Eigen vectors of a matrix	[4L]
3.4	Cayley-Hamilton theorem and its application to find an inverse of a matrix	[3L]
3.5	Method of diagonalization.	[3L]

References:

1. Shanti Narayan: Text book of Matrices, 1/e, S. Chand and Co., New Delhi, Reprint 2020

2. James E. Gentle: Matrix Algebra, 2/e, Springer, 2017.

3. Suddhendu Biswas: Textbook of Matrix Algebra, 3/e, PHI Learning Private Limited, New Delhi, 2012.

4. H. K. Dass, H. C. Saxena, M. D. Raisinghania: Simplified course in Matrices, S. Chand and Co., New Delhi. Edition 1999.

5. H. Anton and C. Rorres: Elementary Linear Algebra, 10/e, Wiley-India Pvt. Ltd., New Delhi.

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	**2**	**3**	**4**	**5**	**6**
Understand the concept of matrices and types of matrices, operations on matrices.	**X**	**X**	**X**			
Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, compute rank of matrix and inverse of matrix by elementary row operations and Quadratic form.	**X**	**X**	**X**	**X**		
Find trace of matrix and its properties and solve the system of homogeneous and non-homogeneous linear equation by row-reduced echelon form.	**X**	**X**				
Calculate eigenvalues and corresponding eigenvectors for a square matrix and use of Cayley- Hamilton theorem and inverse of a matrix using Cayley-Hamilton theorem, Method of diagonalization.	**X**	**X**	**X**			

F.Y. BSc. (MATHEMATICS) SEMESTER II

COURSE TITLE: LAB COURSE I

COURSE CODE: MHMJ-S2PR1-1CR24   [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 -I (MHMJ-S2PR1-1CR24) (Lab Course-I)

1	Examples of operation on Matrix
2	Examples of the Row Echelon form and Row Reduced Echelon form of the matrix
3	Examples of finding Rank of matrix using Row Reduced Echelon form
4	Examples of finding Inverse of Matrix by using Row Reduced Echelon form
5	System of Homogeneous linear equations
6	System of Non-Homogeneous linear equations
7	Eigen vector of the Matrix
8	Verification of Cayley -Hamilton theorem and Inverse of Matrix by using Cayley -Hamilton theorem

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Surat-395001
(Affiliated with Veer Narmad South Gujarat University, Surat)

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

Major Course- II

COURSE TITLE: Integral Calculus & ODE

COURSE CODE: MHMJ-S2P2-3CR24 [CREDITS - 03]

Course Learning Outcomes
At the end of this course, students will be able to   1. Trace the curve of Cartesian and parametric equations.   2. Apply integral calculus to find length of a curve and intrinsic equations.   3. Solve linear differential equations of first order, exact equations, Bernoulli's equations, Lagrange's equation, Clairaut's equation   4. Solve linear differential equations with constant coefficients.

Module 1	Curve Tracing and Application of Integral Calculus	[15L]
Learning objectives: The module is intended to • Develop the skill of tracing the curves. • Develop the skill to use the integral calculus to different problems.		
Learning outcomes: After the successful completion of the module, the learner will be able to • Trace the curve of Cartesian and parametric equations. • Apply integral calculus to find length of a curve and intrinsic equations.		
1.1	Curve Tracing: Equation of the form $y = f(x)$	[3L]
1.2	Curve Tracing: Equation of the form $y^2 = f(x)$	[3L]
1.3	Curve Tracing: Parametric equations.	[3L]
1.4	Application of Integral Calculus: Length of a Curve.	[3L]
1.5	Application of Integral Calculus: Intrinsic equation (except polar coordinates).	[3L]

Module 2	Reduction formulae for integration	[15L]
Learning Objective		
● To develop the skill of solving complex problems of integration using reduction formula.		
Learning Outcomes:		
At the end of this module the learner will be able to		
● Able to derive the reduction formula of integration of various functions.		
2.1	Reduction formulae for integration of $sin^n x, cos^n x$	[5L]
2.2	Reduction formulae for integration of $tan^n x, cot^n x, sec^n x, cosec^n x$	[5L]
2.3	Reduction formulae for integration $sin^p x cos^q x, x^m cosnx, x^m sinnx$	[5L]
Module 3	**Differential equations of first order and higher degree**	**[15L]**
Learning objectives:		
This module is intended to		
● Give knowledge of methods to solve differential equations of first order and higher degree.		
Learning outcome:		
After the successful completion of the module, the learner will be able to ● Solve linear differential equations of first order, exact equations, Bernoulli's equations, Lagrange's equation, Clairaut's equation ● Solve linear differential equations with constant coefficients.		
3.1	Differential equations of first order and higher degree: Solvable for x, y, p	[4L]
3.2	Lagrange's equation	[3L]
3.3	Clairaut's equation	[3L]
3.4	Solution of Linear Differential Equations with constant coefficients: Complimentary functions, Particular Integral, General Solution	[5L]

References:

1. Shanti Narayan and Dr. P.K. Mittal: Integral Calculus, 35/e, S. Chand and Co. New Delhi, 2022.

2. George A. Osborne: Differential and Integral Calculus, D. C. Heath & Co. Publishers, Chicago, Edition 1903.

3. Hari Kishan: Integral Calculus, Atlantic Publishers and Distributer(p) Ltd., Edition 2005.

4. Bansi Lal: Topics in Integral Calculus, 6/e, Firewall Media, 2006.

5. Joseph Edwards: Integral Calculus for Beginners, McMillan and Co., London., Edition 1896

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	**2**	**3**	**4**	**5**	**6**
Trace the curve of Cartesian and parametric equations.		X	X		X	
Apply integral calculus to find length of a curve and intrinsic equations.	X		X			
Solve linear differential equations of first order, exact equations, Bernoulli's equations, Lagrange's equation, Clairaut's equation.	X		X		X	
Solve linear differential equations with constant coefficients.		X			X	

F.Y. B.Sc. (MATHEMATICS) SEMESTER II
COURSE TITLE: LAB COURSE II
COURSE CODE: MHMJ-S2PR2-1CR24   [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 -II (MHMJ-S2PR2-1CR24) (Lab Course-II)	
1	Trace the Cartesian Curves
2	Trace the Parametric Curves
3	Length of the Cartesian Curves and Parametric Curves
4	Intrinsic equation of the Cartesian Curves and Parametric Curves
5	Solution of the various types of differential equations; e.g. solvable for x, y, p
6	Solution of Lagrange's equation and Clairaut's equation
7	Finding General solution of the Differential equation: e^{ax} ,$Sinax$, $Cosax$ and polynomial in terms of x
8	Finding General solution of the Differential equation: $x.V$ and $e^{ax}V$

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

Minor Course- I

COURSE TITLE: Integral Calculus and Matrices

COURSE CODE: MHMN-S2P1-2CR24   [CREDITS - 02]

Course learning outcome
1. Able to derive the reduction formula of integration of various functions
2. Understand the concept of matrices and some special types of matrices and operations on matrices.
3. Apply row reduced echelon form to find the inverse of a Matrix.

Module 1	Reduction formulae for integration	[15L]
Learning Objective		
1. To develop the skill of solving complex problems of integration using reduction formula.		
Learning Outcomes:		
At the end of this module the learner will be able to		
1. Derive the reduction formula of integration of various functions.		
1.1	Reduction formulae for integration of $sin^n x, cos^n x$	[5L]
1.2	Reduction formulae for integration of $tan^n x, cot^n x, sec^n x,$ $cosec^n x$	[5L]
1.3	Reduction formulae for integration $sin^p x cos^q x$, $x^m cosnx$, $x^m sinnx$	[5L]
Module 2	**Some special types and operations on matrices & Row reduced Echelon form**	**[15L]**
Learning Objective		
This module is intended to		

- Understand the use of some special types of matrices and to implement procedures of different properties of addition, subtraction, multiplication and scalar multiplication on matrices.
- Perform Row Elementary operations on matrices and to obtain inverse of matrix.

Learning Outcomes:

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

- Understand the concept of matrices and some special types of matrices and operations on matrices.
- Apply row reduced echelon form to find the inverse of a Matrix.

1.1	Introduction of various types of Matrices, definitions and illustrations.	[2L]
1.2	Operations on Matrices	[2L]
1.3	Properties of operations of Matrices	[2L]
1.4	Elementary row operations.	[2L]
1.5	Row-reduced Echelon form	[3L]
1.6	Inverse of matrix by Row–reduced Echelon form	[4L]

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. Shanti Narayan: Text book of Matrices, 1/e, S. Chand and Co., New Delhi, Reprint 2020.
5. James E. Gentle: Matrix Algebra, 2/e, Springer, 2017.
6. Suddhendu Biswas: Textbook of Matrix Algebra, 3/e, PHI Learning Private Limited, New Delhi, 2012.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Able to derive the reduction formula of integration of various functions	X		X			
Understand the concept of matrices and some special types of matrices and operations on matrices.	X	X	X			
Apply row reduced echelon form to find the inverse of a Matrix.	X	X				

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

COURSE TITLE: MINOR LAB COURSE

COURSE CODE: MHMN-S2PR1-2CR24 [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(MHP-ME-201) (Lab Course - Minor)

1   Examples of Reduction formulae for $\sin^n x$, $\cos^n x$.

2   Examples of Reduction formulae for $\tan^n x$, $\cot^n x$.

3   Examples of Reduction formulae for $\sec^n x$, $\operatorname{cosec}^n x$.

4   Examples of Reduction formulae for $\sin^p x \cos^q x$, $x^m \cos nx$, $x^m \sin nx$.

5   Examples of operations on Matrix

6   Examples of the Row Echelon form and Row Reduced Echelon form of the matrix

7   Examples of finding Rank of matrix using Row Reduced Echelon form

8   Examples of finding Inverse of Matrix by using Row Reduced Echelon form

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

Minor Course- I

COURSE TITLE: Correlation and Regression

COURSE CODE: STMN-S2P1-2CR24 [CREDITS - 02]

Course learning outcome
At the end of this course, Students will be able to
1. The student will demonstrate an understanding of the correlation of two variables
2. Discuss basic ideas of linear regression and correlation.
3. examine the degree and direction of the relationships between two variables
4. Calculate and interpret the correlation coefficient
5. The student will demonstrate an understanding of regression analysis for two variables
6. Calculate and interpret linear regression equations and predict the future values.
7. Understand and interpret coefficient of determination.

Module 1	Linear Correlation	[15L]
Learning Objective		
1. Interpret the nature of relationship between two variables.		
2. Analyze the data and predict the future values using regression lines.		
3. Understand applications of correlation theory in various fields, viz., agriculture, business, medical science, industry etc		

Learning Outcomes:

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

- Describe how correlation is used to identify linear relationships between variables
- Critically examine the degree and direction of the relationships between two variables;

1.1	Bi-variate data Concept about Correlation, definition and Types of correlation	[2L]
1.2	Methods of obtain correlation coefficient (i) Scatter diagram method (with merits and limitations). (ii) Karl Pearson's product moment method (with merits and limitations)	[3L]

	(iii) Spearmen's Rank Correlation method (with derivation, merits and limitations)	
1.3	Interpretation correlation coefficient	[1L]
1.4	Properties of correlation coefficient: -1≤ r ≤ 1 & change of origin & scale, etc.	[3L]
1.5	Numerical Problems of above topics	[6L]
Module 2	**Linear Regression**	**[15L]**

Learning Objective

1. Define the explanatory variable as the independent variable (predictor), and the response variable as the dependent variable (predicted).
2. Plot the explanatory variable (x) on the x-axis and the response variable (y) on the y-axis, and fit a linear regression equation y = ax + b
3. Understand applications of regression theory in various fields, viz., agriculture, business, medical science, industry etc

Learning Outcomes:

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

- Knowing the difference about Correlation & Regression
- Fitting regression lines by using minimum least square methods
- Define correlation of determination.

2.1	Meaning of Linear Regression: Definition	[1L]
2.2	Fitting Regression lines by principal of least squares	[3L]
2.3	Regression coefficients and their properties	[2L]
2.4	Angle between two regression lines & interpretations	[1L]
2.5	Coefficients of determinations & interpretations	[1L]
2.6	Application of regression analyze in various field, Difference between correlation & regression	[1L]
2.7	Numerical problems	[6L]

References:

- A. M. Gun, M. K. Gupta & B. Dasgupta: Fundamentals of Statistics (Volume One) - World Press Private Ltd (1 August 2013)
- S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics – 12/e, Sultan Chand and Sons;
- Barbara Illowsky, Openstax, Susan Dean: Introductory Statistics - Open Stax Textbooks (23 March 2022)
- Neil Weiss: Introductory Statistics – 10/e, Pearson;
- Marvin E Johnson: Basic Statistics - Independently Published; Illustrated Edition. (11 July 2020)

- Prem S. Mann: Introductory Statistics – 10/e, John Wiley & Sons Inc.
- 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
The student will demonstrate an understanding of the correlation of two variables	X	X				
Discuss basic ideas of linear regression and correlation.	X	X				
examine the degree and direction of the relationships between two variables		X	X			
Calculate and interpret the correlation coefficient.	X	X	X			
The student will demonstrate an understanding of regression analysis for two variables by	X	X				
Calculate and interpret linear regression equation x on y and y on x and analyze the data and predict the future values.			X	X	X	
Understand and interpret coefficient of determination,	X	X				

F.Y. B. Sc. (MATHEMATICS) SEMESTER I
COURSE TITLE: MINOR LAB COURSE (Statistics)
COURSE CODE: STMN-S2PR1-2CR24   [Credit- 02]

Course Learning Outcomes
After the successful completion of the Course, the learner will be able to: 1. Compute and interpret a correlation coefficient 2. Compute linear regression lines 3. Define and provide examples of dependent and independent variables in a study of a regression 4. Compute and interpret a coefficient of determination.

PRACTICAL Minor(STP-ME-201) (Lab Course - Minor)	
1	Calculate of the correlation coefficient by Karl pearsons' method for simple series
2	Calculate of the correlation coefficient by Karl pearsons' method for d_x & d_y where $d_x = x - a$ & $d_y = y - b$.
3	Calculate of the correlation coefficient by Karl pearsons' method for d_x & d_y where $d_x = \frac{x-a}{i}$ & $d_y = \frac{y-b}{j}$.
4	Calculate of the correlation coefficient by Karl pearsons' method for bivariate frequency distribution
5	Calculate the correlation coefficient by Spearman's rank method
6	Calculate the regression coefficients for simple series
7	Fitting a regression line X on Y
8	Fitting a regression line Y on X
9	Predict the value of dependent variable by using independent variable
10	Calculate the coefficient of determination & interprets.

Minimum number of experiments: 8

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

Multidisciplinary Course

COURSE TITLE: Matrices and Determinants

COURSE CODE: MHMDC-S2P1-4CR24   [CREDITS - 04]

Course learning outcome
After the successful completion of the Course, the learner will be able to: 1. Understand the concept of matrix and different types of matrices. Also understand conjugate and transpose of a matrix.   2. Understand concept of determinants, minors and cofactors. Also, able to find inverse of a matrix.   3. Understand special types of matrices and able to solve system of linear equations in three variables by Martin's Rule, Cramer's rule.   4. Understand characteristic equation, eigen values, eigen vectors. Able to apply, Cayley-Hamilton theorem to find the inverse of a matrix.

Module 1	Types of Matrices	[15L]
Learning objectives: The module is intended to ● Learn the basics of Matrices and transpose & conjugate of matrix.		

Learning outcomes:		
After the successful completion of the module, the learner will be able to ● Understand the concept of matrix and different types of matrices. Also understand conjugate and transpose of a matrix.		
1.1	Matrix, Types of Matrices, Operation on matrices	[5L]
1.2	Transpose of a matrix	[5L]
1.3	Conjugate of a matrix.	[5L]

Module 2	Determinants	[15L]
Learning objectives: This module is intended to ● Give knowledge of determinants and their properties. ● Develop skill to derive the inverse of a matrix.		

	Learning outcome:	
	After the successful completion of the module, the learner will be able to	
	● Understand concept of determinants, minors and cofactors. Also, able to find inverse of a matrix.	
2.1	Determinants, Properties of determinant, Minors, Cofactors.	[6L]
2.2	Adjoint of a matrix	[3L]
2.3	Inverse of a square matrix, Singular and Non-singular Matrices.	[6L]
Module 3	**Special types of Matrices**	**[15L]**
	Learning objectives:	
	This module is intended to	
	● Give the understanding about special types of matrices.	
	● Make students aware of methods to solve system of linear equations by matrix.	
	Learning outcome:	
	After the successful completion of the module, the learner will be able to	
	● Understand special types of matrices and able to solve system of linear equations in three variables by Martin's Rule, Cramer's rule.	
3.1	Special types of Matrices: Symmetric and Skew Symmetric, Hermitian and skew Hermitian, Orthogonal, Unitary.	[5L]
3.2	Methods to solve system of linear equations in three variables: Martin's Rule	[5L]
3.3	Methods to solve system of linear equations in three variables: Cramer's rule.	[5L]
Module 4	**Eigen values and Eigen vectors**	**[15L]**
	Learning objectives:	
	This module is intended to	
	● Give the knowledge of eigen values and vectors of matrix.	

● Develop the skill to find the inverse of a matrix using theorem.	

Learning outcome:

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

● Understand characteristic equation, eigen values, eigen vectors. Able to apply, Cayley-Hamilton theorem to find the inverse of a matrix.

4.1	Characteristics equation of a matrix, Eigen values, Eigen vectors	[7L]
4.2	Cayley-Hamilton theorem and its application to find an inverse of a matrix.	[8L]

References:

1. Vasistha and Vasistha: Matrices, 18/e, Krishna Prakashan, 2008.

2. Serge Lang: Basic Mathematics, 1/e, Addison -Wesley Publishing Company, 1971.

3. Shanti Narayan: Text book of Matrices, 1/e, S. Chand and Co., New Delhi.

4. Shanti Narayan and P. K. Mittal: A textbook of Matrices, S. Chand, 1953.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Understand the concept of matrix and different types of matrices. Also understand conjugate and transpose of a matrix.	X					
Understand concept of determinants, minors and cofactors. Also, able to find inverse of a matrix.	X		X			
Understand special types of matrices and able to solve system of linear equations in three variables by Martin's Rule, Cramer's rule.	X		X			
Understand characteristic equation, eigen values, eigen vectors. Able to apply, Cayley-Hamilton theorem to find the inverse of a matrix.	X		X		X	

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

Multidisciplinary Course

COURSE TITLE: Ordinary Differential Equations

COURSE CODE: MHMDC-S2P2-4CR24 [CREDITS - 04]

Course learning outcome
After the successful completion of the Course, the learner will be able to:
1. Understand concept of differential equations and solve differential equation of first order.
2. Derive solution of differential equations by separable variable and homogeneous differential equations.
3. Understand and solve exact differential equation, linear differential equation and Bernoulli's equation.
4. Apply this knowledge to solve problems on Linear decay models, Models for growth of Science and Scientists.

Module 1	Differential equation of first order	[15L]
Learning objectives: The module is intended to ● Learn to solve First- Order Differential Equations		
Learning outcomes: After the successful completion of the module, the learner will be able to ● Understand concept of differential equations and solve differential equation of first order		
1.1	Introduction of Differential Equation, Order and Degree of a differential equation	[5L]
1.2	Solution and constants of integration, Derivation (Formation) of a differential equation	[5L]
1.3	General solution, Particular solution.	[5L]
Module 2	**Solution of Differential equations**	**[15L]**
Learning objectives: This module is intended to ● Learn to solve various types of Differential Equations		

	Learning outcome:	
	After the successful completion of the module, the learner will be able to	
	● Derive solution of differential equations by separable variable and homogeneous differential equations.	
2.1	Differential equations of first order and first degree, Separable variable	[5L]
2.2	Homogeneous differential equations	[5L]
2.3	Differential equations reducible to Homogeneous form	[5L]
Module 3	**Exact differential equations**	**[15L]**
	Learning objectives:	
	This module is intended to	
	● Learn to solve differential equations by certain techniques.	
	Learning outcome:	
	After the successful completion of the module, the learner will be able to	
	● Solve exact differential equation, linear differential equation and Bernoulli's equation.	
3.1	Exact differential equations, Necessary and sufficient condition for exact differential equations	[5L]
3.2	Integrating factor, Linear differential equations	[5L]
3.3	Differential equations reducible to Linear form (Bernoulli's equation)	[5L]
Module 4	**Application of differential equations**	**[15L]**
	Learning objectives:	
	This module is intended to	
	● Develop skill to solve problem of different discipline using differential equations.	
	Learning outcome:	
	After the successful completion of the module, the learner will be able to	

- Apply this knowledge to solve problems on Linear decay models, Models for growth of Science and Scientists.

4.1	Application: Linear decay models	[7L]
4.2	Application: Linear decay models, Models for growth of Science and Scientists	[8L]

References:

1. D.A. Murray: Introductory Course in Differential Equations, Orient Longmans, Bombay, 11th Impression 2003.
2. B. S. Grewal: Higher Engineering Mathematics, 42/e, Khanna Publishers, New Delhi, 2012.
3. Zafar Ahasan: Differential Equations and their Applications, 2/e, PHI, New Delhi, 2009.
4. Hari Kishan: Differential Equations, Atlantic Publishers and Distributors, New Delhi, Edition 2006.
5. J. N. Kapoor: Mathematical Modelling, New Age International Publishers, New Delhi, Reprint 2023.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Understand concept of differential equations and solve differential equation of first order.	X	X				
Derive solution of differential equations by separable variable and homogeneous differential equations.		X	X			
Solve exact differential equation, linear differential equation and Bernoulli's equation.		X	X		X	
Apply this knowledge to solve problems on Linear decay models, Models for growth of Science and Scientists.		X	X		X	

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

Multidisciplinary Course

COURSE TITLE: Descriptive Statistics-II

COURSE CODE: MHMDC-S2P3-3CR24   [CREDITS - 03]

Course learning outcome

At the end of this course, Students will be able to

1. Analyze measures of dispersion namely range, quartile deviation, standard deviation and co-efficient of variation for individual, discrete and continuous type data.
2. Familiar with basic concepts of probability
3. Distinguish different types of correlation
4. Calculate Karl Pearson's correlation coefficient & spearman's rank coefficient.
5. Understand the purpose of a linear regression equation;

Module 1	Measures of Dispersion	[08L]

Learning Objective

1. Understand various types of measures of dispersion
2. Differentiate between absolute and relative measures.
3. Learn to calculate different measure of dispersion.

Learning Outcomes:

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

1. Understand the limitations of average and so that uses of various measures of dispersion for analysis of data;
2. Draw meaningful conclusions from a set of data.

1.1	➤ Meaning of dispersion, Significance of measuring variation; ➤ Characteristic of an ideal measure of dispersion, ➤ Absolute and relative measures of dispersion: Range, Quartile deviation, Standard deviation, ▪ Variance and Coefficient of variation,	[08L]

Module 2	Probability	[08L]

Learning Objective

1. Understand axioms of probability and various theorems on probability;
2. Find the probabilities of various events;
3. Understand the concepts of conditional probability and independence of events;

Learning Outcomes:

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

	1. Use of probability to solve real life problem, social science problem, industrial problem and problem arise in science.	
2.1	➢ Concepts in probability, ➢ Some important terms: Random experiment, Sample space, Event, Favourable cases, Mutually exclusive events, Exhaustive events, Equally likely events, Independent events. ➢ Classical and statistical definition of probability, ➢ Axiomatic approach to probability, ➢ Conditional Probability ➢ Theorem based on above topics (Without proof)	[08L]
Module 3	**Linear Correlation and Linear Regression**	**[14L]**

Learning Objective

1. Give introduction & types of correlation
2. Interpret the nature of relationship between two variables
3. Find the correlation coefficient using different methods
4. Find regression line and interpret it.

Learning Outcomes:

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

1. Gain knowledge of basic concept of correlation.
2. Distinguish different types of correlation
3. Calculate Karl Pearson's correlation coefficient & spearman's rank coefficient.
4. Thoroughly understand and analyze the given problems with the regression line.

3.1	➢ Linear Correlation:
	 ▪ Meaning, Definition and Types of correlation,
	 ▪ Methods of studying correlation:
	  (i) Scatter diagram method
	  (ii) Karl Pearson's product moment method
	  (iii)Spearman's Rank Correlation method (Without proof)
	 ▪ Interpretation correlation coefficient,
	 ▪ Properties (Without proof)
		[07L]

3.2	➢ Linear Regression: ▪ Concept of linear regression, ▪ Regression coefficients and Regression lines and their properties (Without proof), ▪ Coefficient Determination and its interpretation, ▪ Utility of study of regression,	[07L]

References:

1. A. M. Gun, M. K. Gupta & B. Dasgupta: Fundamentals of Statistics (Volume One) - World Press Private Ltd (1 August 2013)
2. Sheldon Ross: A First Course in Probability – 10/e, Pearson Education;
3. Seymour Lipschutz, Marc Lipson: Schaum's Outline of Probability – 3/e, McGraw Hill;
4. Barbara Illowsky, Openstax, Susan Dean: Introductory Statistics - Open Stax Textbooks (23 March 2022)
5. Neil Weiss: Introductory Statistics – 10/e, Pearson;
6. Marvin E Johnson: Basic Statistics - Independently Published; Illustrated Edition. (11 July 2020)
7. Prem S. Mann: Introductory Statistics – 10/e, John Wiley & Sons Inc.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Analyse measures of dispersion namely range, quartile deviation, standard deviation and co-efficient of variation for individual, discrete and continuous type data.			X		X	X
Familiar with basic concepts of probability	X	X				
Distinguish different types of correlation	X	X			X	X
Calculate Karl Pearson's correlation coefficient & spearman's rank coefficient.		X	X		X	
Understand the purpose of a linear regression equation		X		X	X	

F.Y. BSc. (MATHEMATICS) SEMESTER II
COURSE TITLE: MDC LAB COURSE
COURSE CODE: MHMDC-S2PR3-1CR24   [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-S2PR3-1CR24) (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 II

Skill Enhancement Course

COURSE TITLE: Fundamentals of Vedic Mathematics- II

COURSE CODE: MHSEC-S2P1-2CR24 [CREDITS - 02]

Course learning outcome
At the end of this course, Students will be able to
1. Distinguish between squaring numbers ending in 5 and squaring numbers near number 50 and manage to simplify algebraic squaring.
2. Apply reverse squaring to find square root of number ending in 5 and manage to solve the square root of perfect square.
3. Identify cube and cube roots, understand and apply division by 9.
4. Understand the concept of division by using straight division.

Module 1	Squaring of Numbers	[15L]
Learning Objective		
1. To understand the concept multiplication of two, three and four digits' numbers. 2. To make students appreciate the amazing computational power of Vedic Sutras.		
Learning Outcomes:		
At the end of this module the learner will be able to 1. Distinguish between squaring numbers ending in 5 and squaring numbers near number 50 and manage to simplify algebraic squaring. 2. Apply reverse squaring to find square root of number ending in 5 and manage to solve the square root of perfect square.		
1.1	Meaning of Ekadhiken Sutram and its applications in finding squaring of numbers ending in 5	[3L]
1.2	Squares by Anurupeyana Sutram, square by Yavdunam thavadunikritya vargamcha yojyet sutram	[4L]

1.3	Squaring by Dwandvayoga sutram, squaring numbers nearest 50	[3L]
1.4	Square roots of perfect square, general method of square roots, cubes by Anurupeyana sutram.	[4L]
Module 2	**Division**	**[15L]**

Learning Objective

   1. Understand the concept of division by using straight division.

Learning Outcomes:

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

   1. Identify cube and cube roots, understand and apply division by 9.

   2. Understand the concept of division by using straight division.

2.1	Decimals and fractions	[1L]
2.2	Division by Nikhilam sutram, division of 1/19, 1/29 by ekadhikenpurven sutram	[2L]
2.3	Division by Paravartya sutram, division by Anurupeyana sutram	[3L]
2.4	Division of polynomials	[1L]
2.5	Factors of general second degree equation by Lopsthapanabhayam Sutram.	[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
Distinguish between squaring numbers ending in 5 and squaring numbers near number 50 and manage to simplify algebraic squaring.	X	X	X			
Apply reverse squaring to find square root of number ending in 5 and manage to solve the square root of perfect square.	X	X	X	X		
Identify cube and cube roots, understand and apply division by 9.	X	X				
Understand the concept of division by using straight division.	X	X	X	X		

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

Skill Enhancement Course

COURSE TITLE: Coordinate Geometry- II

COURSE CODE: MHSEC-S2P2-2CR24 [CREDITS - 02]

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Course learning outcome
At the end of this course, Students will be able to   1. Understand the concept of polar coordinates and their representation.   2. Solve problems involving polar coordinates and parametric equations.   3. Solve real-world problems using coordinate geometry methods.

Module 1	Polar Coordinates and Parametric Equations	[15L]

Learning Objective

1. Explain the concept of polar coordinates and convert between polar and Cartesian coordinates proficiently.
2. Solve problems involving polar coordinates and parametric equations accurately.
3. Apply knowledge of polar coordinates and parametric equations in various contexts, such as representing periodic phenomena or analysing motion along curves.
4. Interpret and communicate solutions in polar and parametric forms effectively.

Learning Outcomes:

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

1. Understand the concept of polar coordinates and their representation.
2. Convert between polar and Cartesian coordinates.
3. Graph equations in polar coordinates.
4. Analyse curves and shapes described by parametric equations.

1.1	Introduction to Polar Coordinates	[1L]
1.2	Conversion between Polar and Cartesian Coordinates	[2L]
1.3	Equations in Polar Coordinates	[2L]

1.4	Graphing Polar Equations	**[3L]**
1.5	Parametric Equations and their Graphs	**[3L]**
1.6	Applications of Polar Coordinates and Parametric Equations	**[3L]**
1.7	Problem-Solving Exercises	**[1L]**
Module 2	**Three-Dimensional Coordinate Geometry**	**[15L]**

Learning Objective

1. Extend understanding of coordinates to three dimensions and visualize points and shapes in 3D space.
2. Analyse equations of lines and planes in three-dimensional space accurately.
3. Understand the concept of vectors and perform vector operations proficiently.
4. Describe equations of spheres and other three-dimensional shapes comprehensively.
5. Apply coordinate geometry concepts to solve problems in three dimensions, such as modelling objects in space or calculating volumes and distances in three-dimensional contexts.

Learning Outcomes:

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

1. Extend their understanding of coordinates to three dimensions.
2. Analyse equations of lines and planes in three-dimensional space.
3. Understand the concept of vectors and vector operations.
4. Describe equations of spheres and other three-dimensional shapes.
5. Apply coordinate geometry concepts to problems in three dimensions.

2.1	Introduction to Three-Dimensional Coordinate Systems	**[1L]**
2.2	Equations of Lines and Planes in Space	**[2L]**
2.3	Vectors in Three Dimensions	**[3L]**
2.4	Vector Operations: Addition, Subtraction, Scalar Multiplication, Dot Product, Cross Product	**[2L]**
2.5	Equations of Spheres and Other Three-Dimensional Shapes	**[3L]**
2.6	Applications of Three-Dimensional Coordinate Geometry	**[2L]**
2.7	Problem-Solving Exercises	**[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.
2. 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 concept of polar coordinates and their representation.	X	X	X			
Solve problems involving polar coordinates and parametric equations.	X	X	X	X		
Solve real-world problems using coordinate geometry methods.	X	X				X

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

Skill Enhancement Course

COURSE TITLE: Basic Mathematics-II

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

Course learning outcome
After the successful completion of the Course, the learner will be able to: 1. Equip themselves with essential mathematical knowledge and skills.   2. Promote problem-solving abilities, demonstrate real-life applications and enhance their employability in the academic field.   2. Develop and enhance mathematical logic relevant to real world applications.   3. Understand the concept of matrices and determinant and some special types of matrices and operations on matrices along with Cramer's rule.

Module 1	Mathematical Logic	[15L]
Learning objectives: The module is intended to ● Develop and enhance mathematical logic relevant to real world applications.		
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	Introduction of Logic, Statement and Connectives	[2L]
1.2	Truth values and truth tables	[2L]
1.3	Equivalent statements and connectives "⇒" and "⇔"	[2L]
1.4	Tautology and contradiction, Algebra of statements	[2L]
1.5	Deductive reasoning, Arguments	[2L]
1.6	Joint denial and compound statements	[2L]
1.7	Applications to switching circuits problems	[3L]

Module 2	Matrices and Determinants	[15L]
Learning objectives: This module is intended to • Understand the use of some special types of matrices and to implement procedures of different properties of addition, subtraction, multiplication and scalar multiplication on matrices and determinants and Cramer's rule.		

Learning outcome:

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

- Understand the concept of matrices and determinant and some special types of matrices and operations on matrices along with Cramer's rule.

2.1	Matrix and types of matrices	[3L]
2.2	Equality of matrices, operations on matrices (transformation, Addition, Subtraction and multiplication of Matrices)	[3L]
2.3	Trace of a Matrix and its Properties	[3L]
2.4	Inverse of Matrix, Adjoint of Matrix	[3L]
2.5	Introduction to Determinants and Cramer's rule	[3L]

References:
1. Serge Lang: Basic Mathematics, 1/e, Addison -Wesley Publishing Company, 1971.
2. Qazi Zameeruddin, V. K. Khanna and S.K. Bhambri: Business Mathematics, 2/e, Vikas Publishing House Pvt. Ltd., 2006.
3. Shanti Narayan: Text book of Matrices, S. Chand and Co., New Delhi.
4. Shanti Narayan and P. K. Mittal: A textbook of Matrices, S. Chand, 1953.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Equip themselves with essential mathematical knowledge and skills, promote problem-solving abilities, demonstrate real-life applications, and enhance their employability in the academic field.	X	X				
Promote problem-solving abilities, demonstrate real-life applications and enhance their employability in the academic field.	X	X	X	X		
Develop and enhance mathematical logic relevant to real world applications.		X		X	X	
Understand the concept of matrices and determinant and some special types matrices and operations on matrices along with Cramer's rule.	X	X	X			

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