Department of Mathematics

Scheme of Examination and Syllabus for
Under Graduate Programme

Under Multiple Entry and Exit, Internship and
CBCS-LOCF as per NEP-2020
w.e.f. session 2024-25 (in phased manner)

Subject: Mathematics

Guru Jambheshwar University of Science &Technology
Hisar-125001, Haryana

(A+ NAAC Accredited State Govt. University)

Guru Jambheshwar University of Science and Technology
Hisar-125001, Haryana
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Scheme of Examination and Syllabus for Under-Graduate Programme for Affiliated Degree Colleges According to National Education Policy-2020

Subject: Mathematics

SEMESTER – I

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours/ Week	External Marks	Internal Marks	Total Marks	Duration of Exam (Hrs)
Discipline Specific Course (DSC)	C24MAT101T	Basic Algebra and Number Theory	3	3	50	20	70	2.5
	C24MAT101P	Basic Algebra and Number Theory Lab	1	2	20	10	30	3
Discipline Specific Course (DSC) #	**C24MAT102T**	**Basic Algebra**	**4**	**4**	**70**	**30**	**100**	**3**
	C24MAT103T	**Calculus - I**	**4**	**4**	**70**	**30**	**100**	**3**
Minor Course (MIC)	C24MIC115T	Sets and Sequences	2	2	35	15	50	2
Minor Course (MIN)#	**C24MIN115T**	**Elementary Mathematics - I**	**4**	**4**	**70**	**30**	**100**	**3**
Multidisciplinary Course (MDC)	C24MDC119T	Mathematics for Everyday Life	3	3	50	25	75	2.5
Skill Enhancement Course (SEC)	C24SEC129T (i)	Vector Calculus and Solid Geometry	2	2	35	15	50	2
	C24SEC129P (i)	Vector Calculus and Solid Geometry Lab	1	2	15	10	25	3
Skill Enhancement Course (SEC)#	**C24SEC129T (ii)**	**Mathematics in PYTHON**	**2**	**2**	**35**	**15**	**50**	**2**
	C24SEC129P (ii)	**Mathematics in PYTHON Lab**	**1**	**2**	**15**	**10**	**25**	**3**
Value Added Course (VAC)	C24VAC114T	Contributions of Indian Mathematicians	2	2	35	15	50	2

#For scheme C only

SEMESTER – II

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours/ Week	External Marks	Internal Marks	Total Marks	Duration of Exam (Hrs)
Discipline Specific Course (DSC)	C24MAT201T	Calculus	3	3	50	20	70	2.5
	C24MAT201P	Calculus Lab	1	2	20	10	30	3
Discipline Specific Course (DSC)#	**C24MAT202T**	**Number Theory and Trigonometry**	**4**	**4**	**70**	**30**	**100**	**3**
	C24MAT203T	**Calculus - II**	**4**	**4**	**70**	**30**	**100**	**3**
Minor Course (MIC)	C24MIC215T	Combinatorics and Geometry	2	2	35	15	50	2
Minor Course (MIN)#	**C24MIN215T**	**Elementary Mathematics - II**	**4**	**4**	**70**	**30**	**100**	**3**
Multidisciplinary Course (MDC)	C24MDC219T	Financial Mathematics	3	3	50	25	75	2.5
Skill Enhancement Course (SEC)	C24SEC229T (i)	Numerical Methods	2	2	35	15	50	2
	C24SEC229P (i)	Numerical Methods Lab	1	2	15	10	25	3
Skill Enhancement Course (SEC)#	**C24SEC129T (ii)**	**Mathematics in PYTHON**	**2**	**2**	**35**	**15**	**50**	**2**
	C24SEC129P (ii)	**Mathematics in PYTHON Lab**	**1**	**2**	**15**	**10**	**25**	**3**
Value Added Course (VAC)	C24VAC114T	Contributions of Indian Mathematicians	2	2	35	15	50	2

#For scheme C only

Programme Outcomes

PO1 **Foundational Knowledge**: Graduates will have a solid understanding of core mathematical concepts including calculus, algebra, geometry, and discrete mathematics.

PO2 **Problem-Solving Skills:** Students will develop strong problem-solving skills and the ability to apply mathematical techniques to solve a wide range of problems in various fields.

PO3 **Critical Thinking and Analytical Skills:** Graduates will demonstrate proficiency in critical thinking and analytical reasoning, enabling them to analyze complex mathematical problems and develop creative solutions.

PO4 **Mathematical Communication:** Students will be able to effectively communicate mathematical ideas and solutions both orally and in writing, using appropriate mathematical notation and language.

PO5 **Computational Proficiency:** Graduates will be proficient in computational methods and mathematical software tools, allowing them to tackle computational problems and analyze data effectively.

PO5 **Understanding of Mathematical Structures:** Students will gain an understanding of mathematical structures such as groups, rings, fields, and vector spaces, and their applications in various contexts.

PO6 **Preparation for Further Study:** The program prepares students for further study in mathematics or related fields at the graduate level, as well as for entry into various careers that require strong mathematical skills.

PO7 **Advanced Mathematical Knowledge:** Graduates will acquire advanced knowledge in specialized areas of mathematics, such as Real Analysis, Complex Analysis, Algebra, Topology, Differential Equations, or Applied Mathematics.

PO8 **Advanced Problem Solving Skills:** Graduates will demonstrate advanced problem solving skills and the ability to tackle complex mathematical problems, advanced numerical problem using advanced techniques and methods.

PO9 **Specialization:** Students will have the opportunity to specialize in a particular area of Pure and Applied Mathematics, gaining in-depth knowledge and expertise in their chosen field of study.

PO10 **Preparation for Career:** The program prepares students for careers in academia, industry, government in mathematics or related fields.

Basic Algebra and Number Theory

Discipline Specific Course (DSC) (Semester I)

Paper Code: C24MAT101T
45 Hrs (3 Hrs /Week) **External Marks: 50**
Credits: 3 **Internal Marks: 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of at least 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *The students will be able to be familiarized with the basics of Algebra and Number Theory and its applications.*

Unit - I

Symmetric, Skew-symmetric, Hermitian and Skew- Hermitian matrices, Elementary operations on matrices, rank of a matrix. Row rank and column rank of a matrix. Eigen values, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

Unit - II

Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices.Relations between the roots and coefficients of general polynomial equation in one variable.

Unit - III

Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Nature of the roots of an equation, Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions (Ferrari's Method).

Unit - IV

Divisibility, G.C.D. (greatest common divisors), L.C.M. (least common multiple), problems based on prime numbers, Fundamental Theorem of Arithmetic. Linear Congruence, Euler's Theorem, Fermat's theorem. Wilson's theorem and its converse. Chinese Remainder Theorem.

Recommended Books:

1. Seymour Lipschutz and Marc Lars Lipson (2013). Linear Algebra (4th Edition).Schaum's Outline Series, McGraw-Hill.
2. K. B. Dutta (2004). Matrix and Linear Algebra. Prentice Hall of India Pvt. Ltd.
3. Vivek Sahai & Vikas Bist (2013). Linear Algebra (2nd edition). Narosa Publishing House.
4. I. Niven (1991). An Introduction to the Theory of Numbers (5th edition). John Wiley & Sons.
5. H.S. Hall and S.R. Knight (2023). Higher Algebra (7th edition). Arihant Publications.
6. Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence (2022). Linear Algebra(5th edition). Prentice Hall of India Pvt. Ltd.
7. Leonard Eugene Dickson (2009). First Course in the Theory of Equations. The Project Gutenberg EBook (http://www.gutenberg.org/ebooks/29785).

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1.Have knowledge of procedure and cognitive skills used in calculating rank of a matrix, eigen values, characteristic equation, minimal polynomial of a matrix and technical skills used in solving problems based on Cayley-Hamilton theorem.

CO2. Have knowledge of the concepts used in solving problems based on relations between the roots and coefficients of general polynomial equation in one variable, solutions of polynomial equations having conditions on roots, common roots and multiple roots.

CO3. Have deeper and procedural knowledge required for solving cubic and biquadratic equations used in Mathematics as well as many other learning fields of study. To understand the basic concepts of number theory and their applications in problem solving and life-long learning.

CO4. Have knowledge of concepts, facts, principles and theories of divisibility, number system, Linear Congruence, Fermat's theorem, Euler's theorem, Wilson's theorem and its converse.

Mapping of CO with PO

C24MAT101T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M

S = strong M = medium W = weak

Basic Algebra and Number Theory Lab

Discipline Specific Course (DSC) (Semester I)

Paper Code: C24MAT101P
30 Hrs (2 Hrs /Week) **External Marks: 20**
Credit: 1 **Internal Marks: 10**
Exam. Time: 3Hrs **Total Marks: 30**

Objective: *The students will be able to understand the basics of Python Language and its Mathematical Applications.*

The following practical will be done using PYTHON Language and their record will be maintained:

Part A:

1. Introduction to PYTHON Language.
2. The history of PYTHON Language.
3. To learn basic commands and applications of PYTHON Language.
4. Learn to use basic operators and function in PYTHON Language.
5. To explore the different menus in PYTHON Language.
6. Learn Keywords/Reserved words in PYTHON Language.
7. To learn the use of predefined functions in PYTHON Language.

Part B:

1. To learn basic operations on matrices.
2. To find the value of a determinant of matrix of order up to four.
3. To compute inverse of square matrix of order up to four.
4. To find Eigen values of square matrix of order up to four.
5. To find Eigen vectors of square matrix of order up to four.
6. To solve system of linear equations.
7. To find roots of quadratic, cubic and biquadratic equations.
8. To find multiple roots of algebraic equations.
9. To discuss nature of roots of an equation.
10. To learn the concept of divisibility in integers.
11. To find the number of divisors of an integer.
12. To find GCD and LCM of two integers.
13. To find the remainder of an integer when divided by the integer.
14. To find the integers x, y such that d = ax + by where d is the g.c.d. of a and b.
15. To solve problem based on the concept of primes.
16. To solve problems based of the concept of linear congruence.

Recommended Books /Download Links:

1. Website Link:www.python.org
2. Rashi Gupta (2002). Making Use of Python. Wiley Publishing, Inc., New York.
3. Peter Norton et.al (2005). Beginning Python. Wiley Publishing, Inc., New York.
4. Wes McKinney (2017). Python for Data Analysis, O'Reilly.http://oreilly.com/catalog/errata.csp?isbn=9781491957660.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Attain cognitive and technical skills required to formulate and solve practical problems involving rank of a matrix, inverse of a matrix, finding the inverse using Cayley Hamilton theorem.

CO2. Have technical and practical skills required for solving algebraic equations, finding inverse and Eigen values of matrices by using built in functions of language.

CO3. To have practical skills to solve cubic and biquadratic equations using Cardon's method, Ferrari's method, Descarte's method.

CO4. To solve the problems based on Euler's theorem and Fermat's theorem and Chinese Remainder theorem.

Mapping of CO with PO
C24MAT101P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	M	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	M	M	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M

S = strong M = medium W = weak

Basic Algebra

Discipline Specific Course (DSC) (Semester I)

Paper Code: C24MAT102T
60 Hrs (4 Hrs /Week) **External Marks: 70**
Credits: 4 **Internal Marks: 30**
Exam. Time: 3 Hrs **Total Marks: 100**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of atleast 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *The course on algebra deals with advance topics on matrices viz. rank, eigen values, homogeneous systems, solution of cubic and bi-quadratics equations.*

Unit -I

Symmetric, Skew-symmetric, Hermitian and skew Hermitian matrices. Elementary operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

Unit –II

Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

Unit-III

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

Unit-IV

Nature of the roots of an equation, Descarte's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Recommended Books:

1. Seymour Lipschutz and Marc Lars Lipson (2013). Linear Algebra. (4thEdition) Schaum's Outline Series, McGraw-Hill.
2. K. B. Dutta (2004). Matrix and Linear Algebra. Prentice Hall of India Pvt. Ltd.
3. Vivek Sahai & Vikas Bist (2013). Linear Algebra (2nd edition). Narosa Publishing House.
4. H.S.Hall and S. R. Knight(2023). Higher Algebra (7th edition). Arihant Publications.
5. Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence (2022). Linear Algebra(5th edition). Prentice Hall of India Pvt. Ltd.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1 Have knowledge of procedure and cognitive skills used in calculating rank of a matrix, eigen values, characteristic equation, minimal polynomial of a matrix,
CO2 Learn technical skills used in solving problems based on Cayley-Hamilton theorem.
CO3 Have knowledge of the concepts used in solving problems based on relations between the roots and coefficients of general polynomial equation in one variable, solutions of polynomial equations having conditions on roots, common roots and multiple roots.
CO4 Have deeper and procedural knowledge required for solving cubic and biquadratic equations used in Mathematics as well as many other learning fields of study.

Mapping of COs with POs
C24MAT102T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	S	M	S
CO2	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	M	S	M	S	M	S	S	M	S	M

S = strong M = medium W = weak

Calculus - I

Discipline Specific Course (DSC) (Semester I)

Paper Code: C24MAT103T
60 Hrs (4 Hrs /Week) **External Marks : 70**
Credits: 4 **Internal Marks : 30**
Exam. Time: 3 Hrs **Total Marks: 100**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of atleast 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *The course on calculus deals with concepts of limit, continuity, differentiability, curve tracing, length of a curve and area between two curves.*

Unit –I

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

Unit –II

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Unit-III

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

Unit-IV

Quadrature (area) Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorems of Pappu's and Guilden.

Recommended Books:

1. Howard Anton, I. Bivens & Stephan Davis (2021). Calculus (12thedition). J. Wiley & Sons.
2. Gabriel Klambauer (1986). Aspects of Calculus (4th edition). Springer.
3. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.
4. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). Thomas' Calculus (14th edition) Pearson Education.
5. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2002). Calculus (3rdedition). Dorling Kindersley (India) Pvt. Ltd.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1 Gain knowledge of the concepts and theory of limit, continuity and differentiability of one variable functions.
CO2 Attain skills of calculating the limit of functions and examining the continuity, discontinuity and differentiability of different types of functions.
CO3 Learn to perform successive differentiation of functions.
CO4 Learn to trace the algebraic curves and polar curves.
CO5 Find the length of the curves and area between two curves.

Mapping of COs with POs
C24MAT103T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	S	M	S
CO2	M	S	S	S	S	S	M	S	S	S
CO3	S	M	S	S	S	S	S	S	M	S
CO4	S	M	S	S	S	S	S	S	M	S
CO5	M	S	S	S	S	S	M	S	S	S

S = strong M = medium W = weak

Sets and Sequences

Minor Course (MIC) (Semester I)

Paper Code: C24MIC115T
30 Hrs (2 Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Objective: *The students will be able to understand the basics of Set Theory and Sequences.*

Unit-I

Sets and their representations, Empty set, Finite and infinite sets, Subsets, Equal sets, Power sets, Universal set, Union and intersection of sets, Difference of two sets, Complement of a set, Venn diagram, De-Morgan's laws and their applications.

Unit-II

Arithmetic progression, Geometric progression, Harmonic progression, Arithmetic mean (A.M.), Geometric mean (G.M.), Harmonic mean (H.M.), Relation between A.M., G.M. and H.M.

Recommended Books:

1. Mathematics Textbook for Class XI (2024). NCERT MART.
2. C.C. Pinter (2014).A Book of Set Theory. Dover Publications.
3. J.V. Dyke,J. Rogers and H.Adams(2011).Fundamentals of Mathematics (10thEdition), Brooks/Cole.
4. A. S Tussy ,R. D Gustafson and D. Koenig (2010). Basic Mathematics for College Students (4thEdition).Brooks/Cole.
5. Shaligram Singh (1994). A Text book of Set Theory. Bharti Bhawan Publications.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Gain knowledge of the concepts of sets, Venn diagrams, De-Morgan's laws, basic set operations.
CO2. Apply the factual knowledge to solve daily life mathematical problems which can be formulated in terms of sets.
CO3. Understanding the concept of Arithmetic progression, geometric progression, harmonic progression and relation between A.M, G.M, H.M.
CO4. Solve the mathematical Problems based on A.P., G.P. and H.P. in day to day life.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	S	M
CO4	S	M	S	S	S	S	S	S	S	M

S = strong M = medium W = weak

Elementary Mathematics-I

Minor Course (MIC) (Semester I)

Paper Code: C24MIN115T
60 Hrs (4 Hrs /Week) **External Marks : 70**
Credits: 4 **Internal Marks : 30**
Exam. Time: 3 Hrs **Total Marks: 100**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of atleast 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *The course on elementary mathematics deals with the concepts of sets, relations, functions, permutation, combinations and coordinate geometry.*

Unit –I

Sets, Relations and Functions: Sets and their Representations, The Empty Set, Finite and Infinite Sets, Equal Sets, Subsets, Universal Set, Venn Diagrams, Operations on Sets, Complement of a Set, Practical Problems on Union and Intersection of Two Sets, Cartesian Product of Sets, Relations, Functions.

Sequences and Series: Sequences, Series, Arithmetic Progression (A.P.), Geometric Progression (G.P.), Relationship Between A.M. and G.M.

Unit –II

Straight Lines: Introduction, Slope of a Line, Various Forms of the Equation of a Line, General Equation of a Line, Distance of a Point From a Line.

Trigonometric Functions: Angles, Trigonometric Functions, Trigonometric Functions of Sum and Difference of Two Angles, Trigonometric Equations.

Unit-III

Permutations and Combinations: Fundamental Principle of Counting, Permutations, Combinations.
Binomial Theorem: Introduction, Binomial Theorem for Positive Integral Indices, General and Middle Terms.

Unit-IV

Linear Inequalities: Inequalities, Algebraic Solutions of Linear Inequalities in One
Variable and their Graphical Representation, Graphical Solution of Linear Inequalities in Two Variables, Solution of System of Linear Inequalities in Two Variables.

Probability: Introduction, Random Experiments, Event, Axiomatic Approach to
Probability, Addition Theorems on Probability, Conditional Probability, Multiplicative Law of Probability.

Recommended Books:

1. Mathematics Textbook for Class XI and XII, (2024) NCERT MART.
2. C. C. Pinter (2014). A Book of Set Theory. Dover Publications.
3. J.V. Dyke, J. Rogers and H. Adams (2011). Fundamentals of Mathematics (10th Edition). Brooks/Cole.
4. A.STussy, R. D Gustafson and D. Koenig (2010). Basic Mathematics for College Students (4th Edition).Brooks Cole.
5. Shaligram Singh (1994). A Text Book of Set Theory. Bharti Bhawan Pub.
6. R. A. Brualdi (2000). Introductory Combinatorics (5th Edition). Pearson Pub.
7. S. L. Loney (2016).The Elements of Coordinate Geometry (Cartesian Coordinates) (2nd Edition). G. K. Publication Private Limited.
8. Ramesh Chandra (2014). Permutation and Combination. Notion Press.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1 Gain knowledge of the concepts of sets, Venn diagrams, De-Morgan's laws, basic set operations.

CO2 Apply the factual knowledge to solve daily life mathematical problems which can be formulated in terms of sets.

CO3 Understanding the concept of Arithmetic progression, geometric progression, harmonic progression and relation between A.M, G.M, H.M.

CO4 Solve the mathematical Problems based on A.P., G.P. and H.P. in day-to-day life.

CO5 Gain knowledge of Fundamental Principle of Counting, Permutations, Combinations.

CO6 To understand the meaning of P(n,r), C(n,r).

CO7 Get introduced with Binomial Theorem for Positive Integral Indices, General and Middle Terms.

CO8 Have procedural knowledge and cognitive skills of solving problems based on Straight Lines like Slope of a Line and learn various Forms of the Equation of a Line

Mapping of COs with POs

C24MIN115T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	S	M	S
CO2	M	S	S	S	S	S	M	S	S	S
CO3	S	M	S	S	S	S	S	S	M	S
CO4	S	M	S	S	S	S	S	S	M	S
CO5	M	S	S	S	S	S	M	S	S	S
CO6	S	S	S	S	S	M	S	M	S	S
CO7	M	S	S	S	S	S	S	S	S	S
CO8	M	S	S	S	S	S	S	S	S	M

S = strong M = medium W = weak

Mathematics for Everyday Life

Multidisciplinary Course (MDC) (Semester I)

Paper Code: C24MDC119T
45 Hrs (3 Hrs /Week) **External Marks: 50**
Credits: 3 **Internal Marks: 25**
Exam. Time: 2.5 Hrs **Total Marks: 75**

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to this, six more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *This course helps the students to understand the fundamentals of Mathematics in daily Life.*

Unit - I

Number system, LCM and HCF of numbers, decimal fractions, square and cube roots. Average, Problems on Numbers, problems on Ages, Surds and Indices, Arithmetic progression and Geometric progression with their simple and basic practical applications, Number series completion.

Unit - II

Percentage, Profit and Loss, Ratio, Proportion and Variation, Partnership, Problems based on the topics of Calendar and Clocks, Average, Average speed problems.

Unit - III

Time and Work, Time and Distance, Area and perimeter of triangles and circle, Area and perimeter of quadrilaterals (Square, Rectangle, Parallelogram, Rhombus, Trapezium), Volume and surface area of Cube, Cuboid, Cylinder, Sphere.

Recommended Books:

1. R. S. Aggarwal (2022). Quantitative Aptitude.S. Chand Publishing.
2. Pinnacle (2022). Quantitative Aptitude for Competitive Examinations. Pinnacle Publications.
3. A.S. Posamentier, C. Spreitzer, Illustrated Edition (2018). The Mathematics of Everyday Life. Prometheus Books.
4. Dinesh Khattar (2013). The Pearson Guide to Quantitative Aptitude for Competitive Examinations. Pearson Publication.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Gain knowledge of facts and concepts of number system, decimal fractions, square and cube roots, LCM and HCF of numbers.
CO2. Have basic knowledge of problems on Average, Numbers, Ages, Surds and Indices.
CO3. Understand the concepts of Percentage, Profit and Loss, Ratio and Proportion, Partnership, Chain Rule.
CO4. Solve the problems based on the topics of Calendar and Clocks.
CO5. Have the cognitive skills to solve the problem based on the concepts of Time and Work, Time and Distance, Area, Volume and Surface Area.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M
CO5	S	S	S	S	S	S	S	M	S	S

S = strong M = medium W = weak

Vector Calculus and Solid Geometry

Skill Enhancement Course (SEC) (Semester I)

Paper Code: C24SEC129T (i)
30 Hrs (2 Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Objective: *The students will be able to be familiarized with the basics of Vectors Calculus, Geometry and their applications.*

Unit - I

Scalar and vector products of three and four vectors, Reciprocal systems of vectors. Differential operators, differentiation and partial differentiation of vector functions. Gradient of a scalar point function, geometrical interpretation of gradient, Divergence and curl of sums and product and their relative identities. Laplacian operator.

Unit - II

General equation of sphere, Diametric form of sphere, Center and radius of sphere, Plane section of a sphere, Sphere through a given circle, Intersection of two spheres, Radical plane of two spheres. Cylinder, Right circular cylinder and enveloping cylinder.

Recommended Books:

1. Robert J. T. Bell (2022). An Elementary Treatise on Coordinate Geometry of Three Dimensions. Legare Street Press.
2. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). Thomas' Calculus (14th edition). Pearson Education.
3. James Stewart (2012). Multivariable Calculus (7th edition). Brooks/Cole Cengage Learning.
4. Murray Spiegel and Seymour Lipschutz (2009). Vector Analysis (2nd edition). Schaum Outline Series.
5. D. Chatterjee (2009). Analytical Geometry: Two and Three Dimensions. Narosa Publishing House.
6. Shanti Narayan and P.K. Mittal (2007). Analytical Solid Geometry. S. Chand and Company.
7. Shanti Narayan and P.K. Mittal (2003). A Text Book of Vector Calculus. S. Chand and Company.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Understand and solve problems related to scalar and vector product of vectors, vector differentiation, directional derivatives, gradient, divergence and curl operators.
CO2. Geometrical interpretation of Gradient, Divergence and Curl.
CO3. Have knowledge of general form of equation of a sphere and attain procedural knowledge required for solving problems related to intersection of spheres, tangent plane, orthogonality of two spheres, length of tangent, director sphere.
CO4. Have the knowledge of Radical plane of two spheres and intersection of sphere with plane.
CO5. Have deeper knowledge of cylinder, enveloping cylinder, right circular cylinder.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	M	S	S	S	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M
CO5	S	S	S	S	S	M	S	S	M	S

S = strong M = medium W = weak

Vector Calculus and Solid Geometry Lab

Skill Enhancement Course (SEC) (Semester I)

Paper Code: C24SEC129P (i)
30 Hrs (2 Hrs /Week) **External Marks: 15**
Credit: 1 **Internal Marks:**
10Exam. Time: 3Hrs **Total Marks: 25**

Objective: *The students will be able to understand the basics of Python Language and its applications in understanding the concept of Vectors and Geometry.*

The following practical will be done using PYTHON Language and their record will be maintained in the practical Notebook:

1. Area of Parallelograms using scalar product.
2. Work done by a force using scalar product.
3. To plot 2-D and 3-D vector field.
4. Find the volume of a parallelepiped using triple product of vectors.
5. Find the gradient of scalar function and its plotting.
6. Find the divergence of vector function and its plotting.
7. Find the curl of vector function and its plotting.
8. Tracing of a sphere of given equation.
9. Tracing of right circular cylinder of given equation.
10. Find the center and radius of sphere.
11. Find the radius of right circular cylinder.

Recommended Books /Download Links:

1. Website Link: www.python.org
2. Rashi Gupta (2002). Making Use of Python. Wiley Publishing, Inc., New York.
3. Peter Norton et. al (2005). Beginning Python. Wiley Publishing, Inc., New York.
4. Wes McKinney (2017). Python for Data Analysis, O'Reilly. http://oreilly.com/catalog/errata.csp?isbn=9781491957660.

Course Outcomes (COs):

At the end of the course, the students would be able to:
CO1. Attain cognitive and technical skills required for plotting of two and three dimensional vector fields.
CO2. Plot gradient of a scalar point function and divergence and curl of vector function.
CO3. Visualize intersection of two spheres and a sphere with a plane.
CO4. Visualize the right circular cylinder and enveloping cylinders.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M

S = strong M = medium W = weak

Mathematics in PYTHON

Skill Enhancement Course (SEC) (Semester I/II)

Paper Code: C24SEC129T (ii)
30 Hrs (2 Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt three questions in all selecting one question from each unit in addition to compulsory Question No. 1.

Objectives: The course on Mathematics in PYTHON deals with the basic concepts of PYTHON Language, basic command, operations and functions.

Unit –I

Introduction and history of PYTHON Language. Basic commands and applications, basic operators and function, the different menus, keywords/reserved words and comments, data type and variables in PYTHON Language.

Unit –II

PYTHON Loops, array, conditional statements, the use of predefined functions, user defined functions, packages, libraries and data base handling.

Recommended Books:

1. Website Link:www.python.org
2. Rashi Gupta (2002), Making Use of Python. Wiley Publishing, Inc., New York.
3. Peter Norton et.al (2005), Beginning Python. Wiley Publishing, Inc.
4. Wes McKinney, (2017), Python for Data Analysis, O'Reilly. http://oreilly.com/catalog/errata.csp?isbn=9781491957660.

Course Outcomes (COs):
At the end of the course, the students would be able to:

CO1 Learn the basic concepts of PYTHON Language like commands, keywords, variables, data types.
CO2 Have the knowledge about loops, conditional statements.
CO3 Apply the knowledge through user defined functions and solve the mathematical problems.
CO4 Learn the different type of packages in PYHTON.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	S	M	S
CO2	M	S	S	S	S	S	M	S	S	S
CO3	S	M	S	S	S	S	S	S	M	S
CO4	S	M	S	S	S	S	S	S	M	S

S = strong M = medium W = weak

Mathematics in PYTHON Lab

Skill Enhancement Course (SEC) (Semester I)

Paper Code: C24SEC129P (ii)
30 Hrs (2 Hrs /Week) **External Marks: 15**
Credit: 1 **Internal Marks: 10**
Time: 3 Hrs **Total Marks: 25**

Objective: *The course on Mathematics in PYTHON lab deals with the technical skills of PYTHON Language, basic command, operations and functions.*

The following practical will be done using PYTHON Language and their record will be maintained in the practical notebook:

1. To learn basic operations on matrices.
2. To find the value of a determinant of matrix of order up to four.
3. To compute inverse of square matrix of order up to four
4. To find Eigen values of square matrix of order up to four.
5. To find Eigen vectors of square matrix of order up to four.
6. To solve system of linear equations
7. To find roots of quadratic, cubic and biquadratic equations.
8. To find multiple roots of algebraic equations.
9. To discuss nature of roots of an equation.
10. To explore the formal definition ($\varepsilon \_ \delta$) of limit.
11. Find derivatives of algebraic, trigonometric, logarithmic, exponential functions etc.
12. To check the symmetry of a given curve.
13. Identifying the zeros, horizontal, vertical and oblique asymptotes of a given function.
14. Illustrating the regions of concave up and concave down of a curve.
15. To find the inflexion point of a curve.
16. To plot curves involving Cartesian and parametric coordinates.
17. To find partial derivatives of a function.
18. To find total differential of a function of two variables.
19. To find the absolute maximum and minimum value of function of one and two variable.
20. To find maxima or minima using method of Lagranges multipliers.

Recommended Books:

5. Website Link:www.python.org
6. Rashi Gupta (2002), Making Use of Python. Wiley Publishing, Inc., New York.
7. Peter Norton et.al (2005), Beginning Python. Wiley Publishing, Inc.
8. Wes McKinney, (2017), Python for Data Analysis, O'Reilly. http://oreilly.com/catalog/errata.csp?isbn=9781491957660.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO5 Learn the basic concepts of PYTHON Language like commands, keywords, variables, data types.
CO6 Have the knowledge about loops, conditional statements.
CO7 Apply the knowledge through user defined functions and solve the mathematical problems.
CO8 Learn the different type of packages in PYHTON.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	S	M	S
CO2	M	S	S	S	S	S	M	S	S	S
CO3	S	M	S	S	S	S	S	S	M	S
CO4	S	M	S	S	S	S	S	S	M	S

S = strong M = medium W = weak

Contributions of Indian Mathematicians

Value Added Course (VAC) (Semester I/II)

Paper Code: C24VAC114T
30 Hrs (2 Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Objective: *This course will help the student to understand the Contributions of Indian Mathematician and their role in the development of Mathematics.*

Unit-I

Contribution in Ancient and Medieval Period: Development of Indian mathematics during Vedic and Ancient period. Overview of the Vedic period, Mathematical ideas in the Vedas and manuscripts in Indian mathematics. Life, background, notable works, mathematical contribution of Baudhayana, Pingala, Aryabhata, Brahmagupta, Bhaskaracharya, Mahaviracharya and Lilavati. Kerala School of Mathematics, Madhava of Sangamagrama, Nilakantha Somayaji, Jyesthadeva: Overview of historical backgrounds and their contribution.

Unit-II

Contribution in Modern Period: Srinivasa Ramanujan, Satyendra Nath Bose, Radhanath Sikdar, P.C. Mahalanobis, D.R. Kaprekar: Early life, Education, Challenges, Achievements and their contribution.
Introduction to the prestigious Ramanujan Award, Fields Medal, Abel Prize and their significance. Biography and contributions of illustrious mathematicians from India: Subrahmanyan Chandrasekhar, C.R. Rao, S.R. Srinivasa Varadhan, Akshay Venkatesh, Harish Chandra.

Recommended Books:

1. C. N. Srinivasiengar (1967). History of Mathematics in India. The World Press Pvt. Ltd., Calcutta.
2. George Gheverghese Joseph (2016). Indian Mathematics: Engaging with the World from Ancient to Modern Times. World Scientific.
3. T.A. Sarasvati Amma (2007). Geometry in Ancient and Medieval India. Motilal Banarsidass Publishers Limited.
4. John Stillwell (2010). Mathematics and its History. Springer (Includes a section on Indian Mathematics).
5. Ramakalyani V. Sita Sunder Ram (2021). History and Development of Mathematics in India. National Mission for Mathematics and D K Printworld (P) Ltd, New Delhi.
6. Gerard G. Emch (2005). Contribution to the History of Indian Mathematics. Hindustan Book Agency.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Have knowledge about the development of mathematical ideas and techniques in Indian mathematics during Vedic and Ancient period.
CO2. Have deeper knowledge about development of mathematics during the Medieval period.
CO3. Learn about the biography and contributions of eminent Indian mathematicians during this period and Indian knowledge system as such.
CO4. Gain knowledge about development of mathematics in modern period.
CO5. Have knowledge of notable work of Srinivasa Ramanujan and other mathematicians with other aspects of the old and strong traditions of mathematics in India.
CO6. Have knowledge about the prestigious Ramanujan Award, Fields Medal, Abel Prize in the subject of mathematics and their significance.

Mapping of CO with PO
C24VAC114T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M
CO5	S	S	M	S	S	S	S	S	S	M
CO6	S	M	S	S	S	S	M	S	S	M

S = strong M = medium W = weak

Calculus

Discipline Specific Course (DSC) (Semester II)

Paper Code: C24MAT201T
45 Hrs (3 Hrs /Week) **External Marks: 50**
Credits: 3 **Internal Marks: 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of at least 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *This course will help the student to understand the basics of functions in one or two variables and their continuity, differentiability and also about the Integral Calculus.*

Unit - I

ε_δ definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin's and Taylor's series expansions.

Unit - II

Indeterminate forms. Limit and continuity of real valued functions of two variables. Partial differentiation. Total differentials, Partial derivatives of Composite functions & Implicit functions using change of variables.

Unit - III

Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables. Differentiability of real valued functions of two variables. Schwarz's and Young's theorem.

Unit - IV

Maxima, minima and saddle points of functions of two variables. Lagrange's method of multipliers. Beta and Gamma Functions, Double and triple integrals.

Recommended Books:

1. Howard Anton, I. Bivens & Stephan Davis (2021). Calculus (12th edition). J. Wiley & Sons.
2. Gabriel Klambauer (1986). Aspects of Calculus (4th edition). Springer.
3. Gorakh Prasad (2016). Differential Calculus (19th edition). PothishalaPvt. Ltd.
4. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). Thomas' Calculus (14th edition). Pearson Education.
5. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2002). Calculus (3rd edition). Dorling Kindersley (India) Pvt. Ltd.
6. Murray R. Spiegel (2002). Theory and Problems of Advanced Calculus (2nd edition). Schaum's Outline Series. Schaum Publishing Co., New York.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Gain knowledge of the concepts and theory of limit, continuity and differentiability of one variable functions.
CO2. Attain skills of calculating the limit of functions and examining the continuity, discontinuity and differentiability of different types of functions.
CO3. Learn to perform successive differentiation of functions.
CO4. To apply the procedural knowledge to obtain the series expansions of functions, having the multidisciplinary applications.

CO5. Attain cognitive and technical skills for indeterminate forms, limit and continuity of real valued functions of two variables.

CO6. To have knowledge about partial differentiation, total differentials, composite functions & implicit functions, change of variables.

Mapping of CO with PO
C24MAT201T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	M	S	M	S	S	S	M
CO4	S	M	S	S	M	S	S	S	S	M
CO5	S	S	M	S	S	S	S	M	S	S
CO6	S	S	S	S	M	S	M	S	S	S

S = strong M = medium W = weak

Calculus Lab

Discipline Specific Course (DSC) (Semester II)

Paper Code: C24MAT201P
30 Hrs (2 Hrs /Week) **External Marks: 20**
Credit: 1 **Internal Marks: 10**
Exam. Time: 3Hrs **Total Marks: 30**

Objective: *The students will be able to understand the basics of Python Language and its applications in understanding the concept of Calculus by plotting the graphs.*

The following practical will be done using PYTHON language and their record will be maintained:
Part A:

1. To learn the basic concepts of limit and limit at infinity.
2. Having the knowledge about tangent line, singular points of a curve
3. To check the symmetry of a curve about x-axis, y-axis and a line.
4. To find the asymptotes of a curve.
5. To visualise the concavity and inflexion point of a curve.
6. Gain the knowledge about the applications of calculus in optimization problems.

Part B:

1. To explore the formal definition ($\varepsilon \_ \delta$) of limit.
2. Find derivatives of algebraic, trigonometric, logarithmic, exponential functions etc.
3. To check the symmetry of a given curve.
4. Identifying the zeros, horizontal, vertical and oblique asymptotes of a given function.
5. Illustrating the regions of concave up and concave down of a curve.
6. To find the inflexion point of a curve.
7. To plot curves involving Cartesian and parametric coordinates.
8. To find partial derivatives of a function.
9. To find total differential of a function of two variables.
10. To find the absolute maximum and minimum value of function of one and two variables.
11. To find maxima or minima using method of Lagrange's multipliers.

Recommended Books /Download Links:

1. Website Link: www.python.org
2. Rashi Gupta (2002). Making Use of Python. Wiley Publishing, Inc., New York.
3. Peter Norton et. al (2005). Beginning Python. Wiley Publishing, Inc., New York.
4. Wes McKinney (2017). Python for Data Analysis, O'Reilly. http://oreilly.com/catalog/errata.csp?isbn=9781491957660.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Attain cognitive and technical skills required for solving different problems of essential calculus associated with plotting of curves, continuity, discontinuity and uniform continuity, differentiability.

CO2. To solve maximization and minimization problems of functions of two variables.

CO3. Have technical and practical skills of solving calculus problems related to differentiation and integration of functions by using PYTHON language.

CO4. Have theoretical knowledge and practical skills for Homogenous functions, Euler's theorem and Expansion of multivalued functions, Maclaurin's and Taylor's series expansions.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M

S = strong M = medium W = weak

Number Theory and Trigonometry
Discipline Specific Course (DSC) (Semester II)

Paper Code: C24MAT202T
60 Hrs (4 Hrs /Week) **External Marks: 70**
Credits: 4 **Internal Marks: 30**
Exam. Time: 3 Hrs **Total Marks: 100**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of atleast 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *The course on number theory and trigonometry deals with the concepts of divisibility, linear congruences, residue system, De Moivre's theorem, trigonometric and hyperbolic functions.*

Unit -I

Divisibility, G.C.D. (greatest common divisors), L.C.M. (least common multiple) Primes, Fundamental Theorem of Arithmetic. Linear Congruences, Fermat's theorem. Wilson's theorem and its converse. Linear Diophantine equations in two variables.

Unit –II

Complete residue system and reduced residue system modulo m. Euler's ϕ function Euler's generalization of Fermat's theorem. Chinese Remainder Theorem. Quadratic residues. Legendre symbols. Lemma of Gauss; Gauss reciprocity law. Greatest integer function [x]. The number of divisors and the sum of divisors of a natural number n (The functions d(n) and σ(n)). Moebius function and Moebius inversion formula.

Unit-III

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

Unit-IV

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series.

Recommended Books:

1. I. Niven and H.S. Zuckerman(1991). An Introduction to the Theory of Numbers (5th edition). John Wiley & Sons.
2. S.L. Loney. Plane Trigonometry Part – II. Macmillan and Company, London.
3. R.S. Verma and K.S. Sukla. Text Book on Trigonometry. Pothishala Pvt. Ltd. Allahabad.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1 Learn the basic concepts of divisibility, GCD, LCM.
CO2 Have knowledge about linear congruences and residue system.
CO3 Solve the problems based on Euler's theorem and Fermat's theorem and Chinese Remainder theorem.
CO4 Solve the problems based on trigonometric and hyperbolic functions using De Moivre's Theorem.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	S	M	S
CO2	M	S	S	S	S	S	M	S	S	S
CO3	S	M	S	S	S	S	S	S	M	S
CO4	S	M	S	S	S	S	S	S	M	S

S = strong M = medium W = weak

Calculus - II

Discipline Specific Course (DSC) (Semester II)

Paper Code: C24MAT203T
60 Hrs (4 Hrs /Week) **External Marks: 70**
Credits: 4 **Internal Marks: 30**
Time: 3 Hrs **Total Marks: 100**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of atleast 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *The course on advance calculus deals with the continuity, differentiability of two variable functions, optimization problems and basic concepts of differential geometry.*

Unit –I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity, chain rule of differentiability. Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

Unit –II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

Unit –III

Differentiability of real valued functions of two variables. Schwarz and Young's theorems. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

Unit –IV

Curves: Tangents, Principal normals, binormals, Serret- Frenet formulae. Locus of the centre of curvature, Spherical curvature, Locus of centre of Spherical curvature, Involutes, evolutes, Bertrand Curves. Surfaces: Tangent planes, one parameter family of surfaces, Envelope.

Recommended Books:

1. Murray R. Spiegel (2002). Theory and Problems of Advanced Calculus (2nd edition). Schaum's Outline Series. Schaum Publishing Co., New York.
2. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.
3. George B. Thomas Jr., Joel Hass, Christopher Heil& Maurice D. Weir (2018). Thomas' Calculus (14th edition). Pearson Education.
4. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2002). Calculus (3rd edition). Dorling Kindersley (India) Pvt. Ltd.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1 Learn the concept of continuity and differentiability of two variable functions.
CO2 Have the knowledge the partial derivatives and optimization problems.
CO3 Gain the knowledge about the differential geometry concepts of principal normals, binormals, Serret-Frenet formulae.
CO4 Learn the concepts of spherical curvature involute and envelope.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	S	S	S	S	S	M	S
CO2	S	S	S	M	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S	S	M	S
CO4	S	S	S	S	S	M	S	S	M	S

S = strong M = medium W = weak

Combinatorics and Geometry

Minor Course (MIC) (Semester II)

Paper Code: C24MIC215T
30 Hrs (2 Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Objective: *To acquaint the students with the topics of Permutations, Combinations and Co-ordinate Geometry.*

Unit - I

Permutations and Combinations: Fundamental Principle of Counting, Permutations, Combinations. Binomial Theorem: Introduction, Binomial Theorem for Positive Integral Indices, General and Middle Terms.

Unit - II

Cartesian system of rectangular coordinates in a plane, distance formula, condition for co-linearity of three points and section formula. Straight Lines: Introduction, Slope of a Line, Various Forms of the Equation of a Line, General Equation of a Line, Distance of a Point From a Line.

Recommended Books/e-resources:

1. Mathematics Textbook for Class XI &XII (2024). NCERT MART.
2. R. A. Brualdi (2000), Introductory Combinatorics, Fifth edition, Pearson Pub.
3. S. L. Loney (2016). The Elements of Coordinate Geometry (Cartesian Coordinates) (2nd Edition). G.K. Publication Private Limited.
4. Ramesh Chandra (2014). Permutation and Combination, Notion Press.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Gain knowledge of Fundamental Principle of Counting, Permutations, and Combinations.
CO2. To understand the meaning of P(n,r), C(n,r).
CO3. Get introduced with Binomial Theorem for Positive Integral Indices, General and Middle Terms.
CO4. Have procedural knowledge and cognitive skills of solving problems based on Straight Lines like Slope of a Line and learn various Forms of the Equation of a Line,
CO5. Learn General Equation of a Line, Distance of a Point from a Line, condition of perpendicularity and parallelness of two lines.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M
CO5	S	S	S	S	M	S	M	S	S	S

S = strong M = medium W = weak

Elementary Mathematics-II

Minor Course (MIC) (Semester II)

Paper Code: C24MIN215T
60 Hrs (4 Hrs /Week) **External Marks: 70**
Credits: 4 **Internal Marks: 30**
Exam. Time: 3 Hrs **Total Marks: 100**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of atleast 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *The course on elementary mathematics deals with the concepts of matrices, limit and continuity, differentiation, integration and solution of ordinary differential equation.*

Unit –I

Matrix Algebra: Introduction, types of matrices, addition and multiplication of matrix, transpose of matrix, concept of elementary row and column operations. Determinant and its properties, minors, cofactors. Application of determinants in finding area of triangle. Adjoint and inverse of square matrix. Solution of homogeneous and non-homogeneous linear equations and condition for solution.

Unit– II

Differential Calculus: Intuitive idea of limit. Limits of polynomials and rational functions trigonometric, exponential and logarithmic functions. Continuity and differentiability of standard functions including function of a function. Differentiation of implicit functions, logarithmic differentiation, parametric differentiation, elements of successive differentiation.

Unit – III

Integral Calculus: Integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, partial fractions and substitution. Formal evaluation of definite integrals

Unit – IV

Ordinary Differential Equations: Definition and formation of ordinary differential equations, equations of first order and first degree, variable separable, homogeneous equations, linear equations (Leibnitz form) and differential equations reducible to these types, Linear differential equation of order greater than one with constant coefficients, complementary function and particular integrals.

Recommended Books

1. Mathematics Textbook for Class XI and XII, (2024) NCERT MART.
2. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018)Thomas' Calculus (14th edition) Pearson Education.
3. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2002). Calculus. (3rd edition) Dorling Kindersley (India) Pvt. Ltd.
4. S. L. Ross (2007). Introduction to ordinary differential equations (3rd edition). Wiley India Pvt. Ltd.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1 Learn the concepts of matrices, determinant of a square matrix and inverse of square matrix.
CO2 Have the knowledge about the concepts of limit and continuity of functions.
CO3 Learn the derivatives and integration of standard functions.
CO4 Find the solution of ordinary differential equations.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	M	S
CO2	S	S	S	M	M	S	M	M	S	S
CO3	M	S	M	S	S	S	S	S	M	S
CO4	S	M	S	S	S	M	S	S	M	S

S = strong M = medium W = weak

Financial Mathematics

Multidisciplinary Course (MDC) (Semester II)

Paper Code: C24MDC219T
45 Hrs (3 Hrs /Week) **External Marks: 50**
Credits: 3 **Internal Marks: 25**
Exam. Time: 2.5 Hrs **Total Marks: 75**

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to this, six more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

Objective: *To familiarize the students with the basic concepts of financial mathematics and data interpretation using statistical tools.*

Unit - I

Simple interest, bank discount, Compound interest, Growth and depreciation of value and population.

Unit - II

Annuities, future value and present value of annuity, total amount of annuity and application of annuity.

Unit - III

Data: Raw and organised data, Frequency, Grouped data. Representation of data: Pictograph, Bar Graphs, Double Bar Graph, Histogram, Pie Charts. Chance and Probability: Chance, Random Experiment, Equally likely outcomes, Outcomes as Events, Probability.

Recommended Books:

1. R. S. Aggarwal (2022). Quantitative Aptitude. S. Chand Publishing.
2. Marek Capinski and Tomasz Zastawniak (2011). Mathematics for Finance. Springer.
3. Ambad Nazri Wahidudin. Financial Mathematics and its Applications. Ventus Publishing ApS
4. Content also available online at: https://onlinecourses.nptel.ac.in/noc20_me36/

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Understand the concepts of Simple interest, bank discount, Compound interest.
CO2. Have the cognitive skill to apply the knowledge about simple interest, bank discount, compound interest in everyday life.
CO3. Learn the concepts of annuity and able to implement this knowledge practically.
CO4. Develop the cognitive skills to analyse the data with data interpretation techniques.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M

S = strong M = medium W = weak

Numerical Methods

Skill Enhancement Course (SEC) (Semester II)

Paper Code: C24SEC229T (i)
30 Hrs (2 Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit.
The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1.

Objective: *To acquaint the students with the basics of Numerical Methods in Algebraic and Transcendental equations and their solution.*

Unit - I

Solution of Algebraic and Transcendental Equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method, Newton's iterative method for finding pth root of a number.
Simultaneous Linear Algebraic Equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method), Gauss Seidel method.

Unit - II

Eigen Value Problems: Power method, Jacobi's method, Given's method. Numerical Solution of Ordinary Differential Equations: Picard's method, Taylor's series method, Euler's method, Modified Euler's method, Runge-Kutta Methods.

Recommended Books:

1. Babu Ram (2009). Numerical Methods (1st edition). Pearson Publication.
2. R.S. Gupta (2015). Elements of Numerical Analysis (2nd edition). Cambridge University Press.
3. M.K. Jain, S.R.K. Iyengar, R.K. Jain (1996). Numerical Methods: Problems and Solutions. New Age International (P) Ltd.
4. M.K. Jain, S.R.K. Iyengar, R.K. Jain (1999). Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd.
5. S.S. Sastry (2012). Introductory Methods of Numerical Analysis (5th edition). PHI Learning Pvt. Ltd.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Gain the knowledge of finding the roots of algebraic and transcendental equations using Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method, Newton's iterative method for finding pth root of a number.
CO2. Have the knowledge of the basic concepts of system of linear equations. Solutions of equations using Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method), Gauss Seidel method.
CO3. Have the conceptual knowledge of Eigen Value Problems: Power method, Jacobi's method, Given's method.
CO4. To attain the knowledge of Numerical solution of ordinary differential equations: Picard's method, Taylor's series method, Euler's method, Modified Euler's method, Runge-Kutta method.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	S	M	S	S	S	S	M

S = strong M = medium W = weak

Numerical Methods Lab

Skill Enhancement Course (SEC) (Semester II)

Paper Code: C24SEC229P (i)
30 Hrs (2 Hrs /Week) **External Marks: 15**
Credit: 1 **Internal Marks:**
10Exam. Time: 3Hrs **Total Marks: 25**

Objective: *The students will be able to understand the basics of Python Language and its applications in solving the different types of equations using different methods.*

The following practical will be done using PYTHON Language and their record will be maintained in the practical Notebook:

1. To find the roots of algebraic and transcendental equations using Bisection method.
2. To find the roots of algebraic and transcendental equations using Regula-Falsi method.
3. To find the roots of algebraic and transcendental equations using Secant method.
4. To find the roots of algebraic and transcendental equations using Newton-Raphson's method.
5. To solve the system of linear equations using Gauss -elimination method.
6. To solve the system of linear equations using Triangularization method.
7. To find the largest eigen value of a matrix using Power method.
8. To find numerical solution of ordinary differential equations using Euler's method.
9. To find numerical solution of ordinary differential equations using Modified Euler's method.
10. To find numerical solution of ordinary differential equations using Runge -Kutta method.

Recommended Books /Download Links:

1. Website Link: www.python.org
2. Rashi Gupta (2002). Making Use of Python. Wiley Publishing, Inc., New York.
3. Peter Norton et. al (2005). Beginning Python. Wiley Publishing, Inc., New York.
4. Wes McKinney (2017). Python for Data Analysis, O'Reilly. http://oreilly.com/catalog/errata.csp?isbn=9781491957660.

Course Outcomes (COs):

At the end of the course, the students would be able to:

CO1. Gain the cognitive and computational skills of finding the roots of algebraic and transcendental equations.
CO2. Enhance the skill of finding numerical solution of system of linear equations.
CO3. Find the numerical solution of Eigen value problems and computation of Eigen values and Eigen vectors.
CO4. To attain the technical knowledge of numerical solution of ordinary differential equations.

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	S	S
CO2	S	S	M	S	M	S	S	S	S	S
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	S	M	S	S	S	S	S	M

S = strong M = medium W = weak