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UNIVERSITY OF CALCUTTA · CCF (NEP 2020) UG SYLLABUS

Mathematics Minor Syllabus

Complete syllabus · Minor stream · MMTH-MN papers

What this file contains

- Minor course structure
- MN-1 to MN-4 detailed syllabus
- IDC: Mathematics in Daily Life
- Question patterns

Source and note

The pages that follow are taken unchanged from the official University of Calcutta syllabus for Mathematics under the Curriculum and Credit Framework for Undergraduate Programmes (CCF, NEP 2020). PALMATHS has only selected the pages for this programme and semester and added this cover so students can find them quickly. Always check the University of Calcutta website (caluniv.ac.in) for later notifications, corrections or changes in paper options. PALMATHS is an independent coaching centre and is not part of, or endorsed by, the University of Calcutta.

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University of Calcutta



Syllabus for four-year (Eight Semester) B. Sc. Honours and Honours with Research Course with Mathematics Major

&

Mathematics as a Minor subject

and

Syllabus for three-year (Six Semester) Multidisciplinary Course with Mathematics

Under

Curriculum and Credit Framework (CCF)

Odd Semester : July to December

Even Semester : January to June

The syllabus for the 4 Year B.A./B.Sc. Honours and Honours with Research Course with Mathematics Major is effective from the academic year **2023-24**.

The syllabus for the 3 Year Multidisciplinary Course with Mathematics is effective from the academic year **2023-24**.

Semesterwise Courses at a glance

Semester	Course	Paper Code	Name of Paper	Credit	Page
ONE (I)	MAJOR	MTHM-DSCC 1	Calculus, Geometry & Vector Analysis	3TH+1TU = 4	10
	MAJOR	MTHM-SEC 1	C language with Mathematical Applications	3TH+1TU = 4	73
	MINOR	MMTH-MN1	Calculus, Geometry & Vector Analysis	3TH+1TU = 4	10
	MDC	MMTH-MDC-CC1	Calculus, Geometry & Vector Analysis	3TH+1TU = 4	10
	MDC	MMTH-SEC	C language with Mathematical Applications	3TH+1TU = 4	73
	IDC	MTHD-IDC	Mathematics in Daily Life	2TH+1TU = 3	92
TWO (II)	MAJOR	MTHM-DSCC 2	Basic Algebra	3TH+1TU=4	12
	MAJOR	MTHM-SEC 2.1 or MTHM-SEC 2.2	Python Programming and Introduction to Latex or Artificial Intelligence	3TH+1TU=4	75
	MINOR	MMTH-MN2	Basic Algebra	3TH+1TU=4	12
	MDC	MMTH-MDC-CC2	Basic Algebra	3TH+1TU=4	12
	MDC	MMTH-SEC	C language with Mathematical Applications	3TH+1TU=4	73
	IDC	MTHD-IDC	Mathematics in Daily Life	2TH+1TU=3	92
THREE (III)	MAJOR	MTHM-DSCC 3	Real Analysis	3TH+1TU=4	14
	MAJOR	MTHM-DSCC 4	Ordinary Differential equations - I & Group Theory - I	3TH+1TU=4	16
	MAJOR	MTHM-SEC 3	Linear Programming & Rectangular Games	3TH+1TU=4	78
	MINOR	MMTH-MN1	Calculus, Geometry & Vector Analysis	3TH+1TU=4	10
	MDC	MMTH-MDC-CC3	Ordinary Differential equations & Group Theory	3TH+1TU=4	80
	MDC	MMTH-SEC	C language with Mathematical Applications	3TH+1TU=4	73
	MDC	MMTH-MDC-mn1	Calculus, Geometry & Vector Analysis	3TH+1TU=4	10
	IDC	MTHD-IDC	Mathematics in Daily Life	2TH+1TU=3	92
FOUR (IV)	MAJOR	MTHM-DSCC 5	Theory of Real Functions	3TH+1TU=4	18
	MAJOR	MTHM-DSCC 6	Mechanics - I	3TH+1TU=4	20
	MAJOR	MTHM-DSCC 7	Multivariate Calculus - I & Partial Differential Equation - I	3TH+1TU=4	22
	MAJOR	MTHM-DSCC 8	Group Theory - II & Ring Theory - I	3TH+1TU=4	25
	MINOR	MMTH-MN2	Basic Algebra	3TH+1TU=4	12
	MDC	MMTH-MDC-CC4	Mechanics	3TH+1TU=4	82
	MDC	MMTH-MDC-CC5	Advanced Calculus	3TH+1TU=4	84
	MDC	MMTH-MDC-mn2	Basic Algebra	3TH+1TU=4	12
FIVE (V)	MAJOR	MTHM-DSCC 9	Probability & Statistics	3TH+1TU=4	27
	MAJOR	MTHM-DSCC 10	Ring Theory - II & Linear Algebra - I	3TH+1TU=4	29
	MAJOR	MTHM-DSCC 11	Riemann Integration & Series of Functions	3TH+1TU=4	31
	MAJOR	MTHM-DSCC 12	Mechanics - II	3TH+1TU=4	33
	MINOR	MMTH-MN3	Ordinary Differential equations & Group Theory	3TH+1TU=4	80
	MINOR	MMTH-MN4	Mechanics	3TH+1TU=4	82
	MDC	MMTH-MDC-CC6	Statistics & Numerical Analysis	3TH+1TU=4	86
	MDC	MMTH-MDC-CC7	Mathematical Methods	3TH+1TU=4	88
	MDC	MMTH-MDC-mn3	Ordinary Differential equations & Group Theory	3TH+1TU=4	80
	MDC	MMTH-MDC-mn4	Mechanics	3TH+1TU=4	82
SIX (VI)	MAJOR	MTHM-DSCC 13	Metric Space & Complex Analysis - I	3TH+1TU=4	35
	MAJOR	MTHM-DSCC 14	Multivariate Calculus - II & Applications of Calculus	3TH+1TU=4	37
	MAJOR	MTHM-DSCC 15	Numerical Analysis	3TH+1P=4	39
	MINOR	MMTH-MN3	Ordinary Differential equations & Group Theory	3TH+1TU=4	80
	MINOR	MMTH-MN4	Mechanics	3TH+1TU=4	20
	MDC	MMTH-MDC-CC7	Mathematical Methods	3TH+1TU=4	88
	MDC	MMTH-MDC-CC8	Discrete Mathematics	3TH+1TU=4	90
	MDC	MMTH-MDC-mn5	Advanced Calculus	3TH+1TU=4	84
	MDC	MMTH-MDC-mn6	Statistics & Numerical Analysis	3TH+1TU=4	86

Course Structure for

4-year B.A./B.Sc. Honours & Honours with Research, with Mathematics as a Minor Subject

Semester	Paper Code	Name of Paper	Credit	Page No.
I	MMTH-MN1	Calculus, Geometry & Vector Analysis	3TH+1TU = 4	10
II	MMTH-MN2	Basic Algebra	3TH+1TU = 4	12
III	MMTH-MN1	Calculus, Geometry & Vector Analysis	3TH+1TU = 4	10
IV	MMTH-MN2	Basic Algebra	3TH+1TU = 4	12
V	MMTH-MN3	Ordinary Differential equations & Group Theory	3TH+1TU = 4	80
	MMTH-MN4	Mechanics	3TH+1TU = 4	82
VI	MMTH-MN3	Ordinary Differential equations & Group Theory	3TH+1TU = 4	80
	MMTH-MN4	Mechanics	3TH+1TU = 4	82

Note :

1. MMTH-MN1 and MMTH-MN2 shall be studied in either Semester One and Two respectively or in Semester Three and Four respectively.
2. MMTH-MN3 and MMTH-MN4 (both) shall be studied in either Semester Five or in Semester Six.

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Calculus, Geometry & Vector Analysis

Semester : I	Paper Code : MTHM-DSCC 1-TH MMTH-MN1-TH MMTH-MDC-CC1-TH
Semester : III	Paper Code : MMTH-MN1-TH MMTH-MDC-mn1-TH
Credit : 4	Full Marks : 100 (Theory : 75 & Tutorial : 25)
Minimum number of classes required : 60	

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Course Outcome

CO1 : To understand and compute higher-order derivatives, apply Leibniz's rule and its applications, and use L'Hospital's rule to evaluate limits.

CO2 : To develop proficiency in solving problems involving higher-order derivatives, Leibniz's rule, and L'Hospital's rule.

CO3 : To learn reduction formulae and apply them to determine the arc length of a curve, the area under a curve, and the area and volume of surfaces of revolution.

CO4 : To study the classification of conic sections, reduce them to canonical form, and determine equations of tangents, normals, and polars.

CO5 : To acquire detail knowledge of spheres, cylindrical surfaces, central conicoids, different quadric surfaces.

CO6 : To apply vector equations to problems in geometry and mechanics, and to perform differentiation and integration of vector functions.

Group A : Calculus [Marks : 20] [16 classes]

- Differentiability of a function at a point and in an interval. Meaning of sign of derivative. Differentiating Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to functions of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$. Indeterminate forms. L'Hospital's rule (statement and example).
- Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int \sec^n x dx$, $\int (\log x)^n dx$, $\int \sin^n x \sin mx\, dx$, $\int \sin^n x \cos^m x\, dx$. Parametric equations, parametrizing a curve, arc length of a curve, arc length of parametric curves, area under a curve, area and volume of surface of revolution.

Group B : Geometry [Marks : 35] [28 classes]

- Rotation of axes and second degree equations, classification of conics using the discriminant, reduction to canonical form, tangent and normal, polar equations of conics.
- Spheres, Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, generating lines, identification of quadric surfaces like cone, cylinder, ellipsoid, hyperboloid, classification of quadrics.

Group C : Vector Analysis [Marks : 20] [16 classes]

- Triple product, vector equations, applications to geometry and mechanics — concurrent forces in a plane, theory of couples, system of parallel forces. Introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions of one variable.

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4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Basic Algebra

Semester : II	Paper Code : MTHM-DSCC 2-TH MMTH-MN2-TH MMTH-MDC-CC2-TH
Semester : IV	Paper Code : MMTH-MN2-TH MMTH-MDC-mn2-TH
Credit : 4	Full Marks : 100 (Theory : 75 & Tutorial : 25)
Minimum number of classes required : 60	

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Course Outcome

CO1 : To study exponential, logarithmic, trigonometric, and hyperbolic functions of a complex variable.

CO2 : To develop the ability to solve cubic and biquadratic equations.

CO3 : To acquire knowledge of equivalence relations, partial order relations, linear order relations, and composition of mappings.

CO4 : To understand the well-ordering property of positive integers, the division algorithm, and congruence relations among integers.

CO5 : To learn about the existence and uniqueness of solutions to systems of linear equations, including row reduction and echelon forms.

CO6 : To study the algebraic and geometric properties of vectors in n-dimensional space, including linear independence and its algebraic and geometric characterizations.

Group A [Marks : 25] [20 classes]

- Polar representation of complex numbers, n-th roots of unity, De Moivre's theorem for rational indices and its applications. Exponential, logarithmic, trigonometric and hyperbolic functions of complex variable.
- Theory of equations : Relation between roots and coefficients, transformation of equation, Descartes rule of signs, application of Sturm's theorem, cubic equation (solution by Cardan's method) and biquadratic equation (solution by Ferrari's method).
- Inequalities : The inequality involving $AM \geq GM \geq HM$, Cauchy-Schwartz inequality.

Group B [Marks : 25] [20 classes]

- Relation : equivalence relation, equivalence classes & partition, partial order relation, poset, linear order relation.
- Mapping : composition of mappings, relation between composition of mappings and various set theoretic operations. Meaning and properties of $f^{-1}(B)$, for any mapping $f : X \to Y$ and $B \subseteq Y$.
- Well-ordering property of positive integers, Principles of Mathematical induction, equivalence of Well-ordering property and Principles of Mathematical induction (statement only), division algorithm, divisibility and Euclidean algorithm. Prime numbers and their properties, Euclid's theorem. Congruence relation between integers. Fundamental Theorem of Arithmetic. Chinese remainder theorem. Arithmetic functions, some arithmetic functions such as φ, τ, σ and their properties.

Group C [Marks : 25] [20 classes]

- Systems of linear equations, homogeneous and non-homogeneous systems. Existence and uniqueness of solution. The matrix equation $Ax = b$, row reduction and echelon forms, uniqueness of reduced echelon form. Rank of a matrix and characterization of invertible matrices, Pivot positions, basic and free variables, parametric description of the solution set. Existence and uniqueness theorem.
- Vectors in $\mathbb{R}^n$, algebraic and geometric properties of the vectors. Vector form of a linear system and the column picture. Existence of solutions and linear combination of vectors. Geometry of linear combination and subsets spanned by some vectors. Uniqueness of solution and Linear independence of vectors. Algebraic and geometric characterizations of linearly independent subsets.

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[6] David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.

[7] Gilbert Strang, Introduction to Linear Algebra, 5th Ed., Wellesley-Cambridge Press, 2019.

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Ordinary Differential Equations & Group Theory

Semester : III	Paper Code : MMTH-MDC-CC3-TH
Semester : V	Paper Code : MMTH-MDC-mn3-TH
Semester : V or VI	Paper Code : MMTH-MN3-TH
Credit : 4	Full Marks : 100 (Theory : 75 & Tutorial : 25)
Minimum number of classes required : 60	

4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Course Outcome

CO1 : To understand the formation of differential equations and the methods for solving them.

CO2 : To learn techniques for solving first-order, first-degree, and higher-degree differential equations.

CO3 : To study methods for solving higher-order linear and nonlinear differential equations.

CO4 : To study the algebraic structure of groups, including elementary properties, subgroups, order of a group, cyclic groups, alternating groups, and related concepts.

Group A : Ordinary Differential Equations [Marks : 45] [36 classes]

- Formation of differential equations, order and degree of a differential equation. First order and first degree differential equations. Homogeneous and exact differential equations, conditions for an equation of the first order to be exact. Integrating factors. Rules for finding integrating factors. Linear equations and Bernoulli equations.
- First order higher degree differential equations solvable for x, y and p. Clairaut's forms. Singular solutions. Equations of tac-locus, nodal locus and cuspidal locus.
- Higher order linear and non-linear equations. Concept of Wronskian and its properties. Complementary functions, particular integrals. Linear homogeneous and non-homogeneous equations with constant coefficient. Method of undetermined coefficients. Method of variation of parameters. Simultaneous linear differential equations.
- Higher order linear equations with variable coefficients reducible to linear equations with constant coefficients (Euler's equation). Condition for exactness of higher order linear equations. Integrating factors. Equations of the form $\frac{d^n y}{dx^n} = f(y)$ $(n \geq 2)$.

Group B : Group Theory [Marks : 30] [24 classes]

- Definition of a group, examples of groups including permutation groups, dihedral groups and quaternion groups (through matrices), elementary properties of groups, examples of commutative and non-commutative groups. Subgroups and examples of subgroups, necessary and sufficient condition for a nonempty subset of a group to be a subgroup. Normalizer, centralizer, center of a group, product of subgroups.
- Order of an element of a group, order of a group. Cyclic groups. Properties of cyclic groups, classification of subgroups of cyclic groups. Permutation, cycle notation for permutations, properties of permutation, even and odd permutations. Alternating group. Properties of cosets. Lagrange's theorem and consequences including Fermat's Little theorem.

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4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Mechanics

Semester : IV	Paper Code : MMTH-MDC-CC4-TH
Semester : V	Paper Code : MMTH-MDC-mn4-TH
Semester : V or VI	Paper Code : MMTH-MN4-TH
Credit : 4	Full Marks : 100 (Theory : 75 & Tutorial : 25)
Minimum number of classes required : 60	

4-yr Credit Distribution | MDC Credit Distribution | Course Overview
Major | Minor | MDC | Question Pattern

Course Outcome

CO1 : To understand the principles of forces, including resultant forces, resultant couples, and coplanar force systems.

CO2 : To study rectilinear motion and simple harmonic motion.

CO3 : To develop the ability to solve problems related to work, power, and energy.

CO4 : To study impulsive forces and the collision of elastic bodies.

CO5 : To develop the ability to solve problems involving the motion of a particle in two dimensions.

Statics - I

- Idea about Physical Independence Principle of Forces, Principle of transmissibility of a force, Principle of action and reaction and Principle of parallelogram law of forces, Composition and resolution of forces, Concurrent Forces in a plane, Composition and resolution of forces, Equilibrium of three forces acting at a point, Lami's theorem, Moment of a force about a point and an axis, Varignon's theorem, Resultant forces and resultant couple, Coplanar forces: Its reduction and conditions of equilibrium. [8 classes]

Particle Dynamics - I

- Law of gravitation, Concept of inertial frame, Newton's laws of motion, Concept of equation of motion of a particle, Rectilinear motion in a given force field, Simple harmonic motion, damped and forced oscillations, Concept of resonance, motion of elastic strings, Rectilinear motion under uniform gravity, Rectilinear motion in a resisting medium where resistance is proportional to velocity. [18 classes]
- Work, power, energy, Conservative forces, Potential energy, Existence of potential energy function, Conservative field and Principle of conservation of energy.
. [6 classes]
- Impulse of a force, Impulsive force, Principle of conservation of linear momentum, Collision of elastic bodies: Coefficient of restitution, Newton's law of collision, Direct and oblique impact of a smooth sphere with a fixed plane, Direct and oblique impact of two smooth spheres. [8 classes]
- Motion of a particle in a plane (2D Cartesian): Angular velocity and angular acceleration, Expressions for components of velocity and acceleration, Tangential and normal components of velocity and acceleration, Motion of a projectile in a resisting medium under gravity. Motion of a particle in a plane (2D Polar): Expressions for components of velocity and acceleration, Central forces and central orbits, Motion under inverse square law, Times of describing the arcs of central orbits for a particle moving under inverse square

law, Kepler's laws on planetary motion, Motion of artificial satellites, Tangential and normal components of velocity and acceleration, Constrained motion of a particle on smooth curve. [20 classes]

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4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Mathematics in Daily Life - I

Semester : I / II / III	Paper Code : MTHD-IDC-TH
Credit : 3	Full Marks : 75 (Theory : 50 & Tutorial : 25)
Minimum number of classes required : 45	

4-yr Credit Distribution | MDC Credit Distribution | Course Overview
Major | Minor | MDC | Question Pattern

Course Outcome

CO1 : To learn basic ideas of set theory.

CO2 : To learn mathematics of integers behind ISBN, UPC, VISA, MASTER card nos.

CO3 : To get an idea of propositional logic, logical connectives.

CO4 : To learn basics of linear programming problems.

CO5 : To learn financial mathematics at elementary level.

Group A : Basics of Set Theory [Marks : 4] [4 classes]

- Concept and definition of sets, subsets and set operations (Union, Intersection, Complementation, Subtraction); Statements of basic laws of set algebra.
- Venn diagrams. Statement of the formula $n(A \cup B) = n(A) + n(B) - n(A \cap B)$ and its application in daily life.

Group B : Understanding Integers [Marks : 20] [18 classes]

- Statement and simple problems on First Principle of Mathematical Induction.
- Statement of Division algorithm; G.C.D. of two positive integers, Expression of G. C. D. of two integers x, y in the form $px + qy$ (p, q are integers) (Euclidean Algorithm without proof).
- Representation of a positive integer in Binary and decimal mode.
- Linear Diophantine equation in two variables: Statement of condition on the existence of integral solution, General / particular solution, Simple real life applications;
- Prime Integers. Some elementary properties of prime integers (only statement), Fundamental theorem of Arithmetic (only statement), Algorithm for Primality test.
- Congruence of Integers: Meaning of $a \equiv b \ (mod\ m)$, Statements of elementary properties of congruence; If $a \equiv b \ (mod\ m)$ then for any integer c, $(a+c) \equiv (b+c) \ (mod\ m)$, $(a–c) \equiv (b–c) \ (mod\ m)$, $ac \equiv bc \ (mod\ m)$, $a^n \equiv b^n \ (mod\ m)$ for natural numbers n.
- Application of congruence of integers: Divisibility tests by 2, 3, 4, 5, 7, 9, 11, 13 (Statements of relevant results and problems only), Check Digits in International Standard Book Number (ISBN), Universal Product Code (UPC), VISA and MASTER card (Statements of relevant results and Problems only), Formation of Round Robin Tournament Table using congruence of integers (Technique and Problems only).

Group C : Mathematical Logic [Marks : 7] [6 classes]

- Proposition, propositional variables and propositional Logic.

- Logical Connectives: NOT (Negation), OR (Disjunction), AND (Conjunction), Exclusive OR (XOR), IMPLICATION (If p then q) and BI-IMPLICATION (If and only if) and their Truth Tables; Truth value of a proposition, Truth tables of expressions involving more than one logical connective.
- Tautology, logical consequence, logical equivalence, contradiction.

Group D : Basics of Operations Research [Marks : 9] [8 classes]

- Idea of Linear Programming Problems: Objective function, decision variables, constraints.
- Formulation of daily life problems as an LPP (e.g. Carpenter problem, preparation of mixtures of chemicals, diet problems etc.).
- Solution of an LPP by graphical method (only bounded region).
- Definition of Game, Examples from daily life, Two person zero sum game, Strategy, Payoff, Saddle point, Solution of a game problem with saddle point (only elementary problems).

Group E : Financial Mathematics [Marks : 10] [9 classes]

- Time value of money - Simple interest and Compound interest (Fundamental Formulae); Interest payable monthly, quarterly, annually (only problems).
- Ordinary Simple Annuities – Accumulated value and Discounted Value of an ordinary simple annuity – Idea of repayment of loans, Simple problems. (No formula derivation).
- Problems on Dividend calculation and Calculation of income tax on taxable income (old and new regime).

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4-yr Credit Distribution | MDC Credit Distribution | Course Overview

Major | Minor | MDC | Question Pattern

Question Pattern for

3-year Multidisciplinary Course with Mathematics and Mathematics as a Minor subject

MMTH-MN1-TH **MMTH-MDC-mn1-TH** **MMTH-MDC-CC1-TH**	**Calculus, Geometry & Vector Analysis**
Group A : Calculus (Marks : 20)	(a) Short answer type questions: 4 questions are to be attempted out of 7 questions each carrying 2 marks. (b) Long answer type questions: 3 questions are to be attempted out of 6 questions each carrying 4 marks.
Group B : Geometry (Marks : 35)	(a) Short answer type questions: 2 questions are to be attempted out of 4 questions each carrying 2.5 marks (b) Long answer type questions: 5 questions are to be attempted out of 9 questions each carrying 6 marks
Group C : **Vector Analysis** (Marks : 20)	(a) Short answer type questions: 4 questions are to be attempted out of 7 questions each carrying 2 marks. (b) Long answer type questions: 3 questions are to be attempted out of 6 questions each carrying 4 marks.
MMTH-MN2-TH **MMTH-MDC-mn2-TH** **MMTH-MDC-CC2-TH**	**Basic Algebra**
Group A, B, C : (Each group carries 25 marks)	(a) Short answer type questions: 2 questions are to be attempted out of 4 questions each carrying 2.5 marks. (b) Long answer type questions: 4 questions are to be attempted out of 7 questions each carrying 5 marks.
MMTH-SEC-TH	**C Language with Mathematical Applications**
(Marks : 75)	(a) Short answer type questions: 5 questions are to be attempted out of 8 questions each carrying 3 marks. (b) Long answer type questions: 5 questions are to be attempted out of 8 questions each carrying 8 marks. (a) Longer answer type questions: 2 questions are to be attempted out of 4 questions each carrying 10 marks.

MMTH-MN3-TH **MMTH-MDC-mn3-TH** **MMTH-MDC-CC3-TH**	**Ordinary Differential Equations & Group Theory**
Group A: Ordinary Differential Equations (Marks : 45)	9 questions are to be attempted out of 16 questions each carrying 5 marks.
Group B : Group Theory (Marks : 30)	6 questions are to be attempted out of 10 questions each carrying 5 marks.
MMTH-MN4-TH **MMTH-MDC-mn4-TH** **MMTH-MDC-CC4-TH**	**Mechanics**
(Marks : 75)	(a) Short answer type questions: 6 questions are to be attempted out of 10 questions each carrying 2 marks. (b) Long answer type questions: (i) 7 questions are to be attempted out of 11 questions each carrying 6 marks. (2 questions from Statics, 4 questions from Law of gravitation portion, 3 questions from Work, Power, Energy portion and 2 questions from Impulse of a force portion are to be set.) (ii) 3 questions are to be attempted out of 6 questions each carrying 7 marks. (questions are to be set from Motion of a particle in a plane)
MMTH-MDC-CC5-TH **MMTH-MDC-mn5-TH**	**Advanced Calculus**
Group A: (Marks : 20)	4 questions are to be attempted out of 7 questions each carrying 5 marks.
Group B : (Marks : 25)	5 questions are to be attempted out of 9 questions each carrying 5 marks.
Group C : (Marks : 30)	6 questions are to be attempted out of 10 questions each carrying 5 marks.
MMTH-MDC-CC6-TH **MMTH-MDC-mn6-TH**	**Statistics & Numerical Analysis**
Group A: Statistics (Marks : 50)	(i) 5 questions are to be attempted out of 9 questions each carrying 5 marks. Each question may have further parts. These 9 questions must be set from Probability Theory, Probability Distribution and Mathematical Expectation. (ii) 5 questions are to be attempted out of 9 questions each carrying 5 marks. Each question may have further parts. These 9 questions must be set from Elements of Statistical Methods, Statistical Inference, Sampling Theory
Group B : Numerical Analysis (Marks : 25)	5 questions are to be attempted out of 9 questions each carrying 5 marks. Each question may have further parts.

Question Pattern for
Interdisciplinary Course (IDC) in Mathematics

MTHD-IDC	Mathematics in Daily Life
Group A : **Basics of set theory** (Marks : 4)	1 question is to be attempted out of 2 questions each carrying 4 marks.
Group B : **Understanding integers** (Marks : 20)	5 questions are to be attempted out of 8 questions each carrying 4 marks.
Group C : **Mathematical Logic** (Marks : 7)	1 question is to be attempted out of 3 questions each carrying 7 marks. Each questions may have multiple parts.
Group D : Basics of Operations Research (Marks : 9)	1 question is to be attempted out of 3 questions each carrying 9 marks. Each questions may have multiple parts.
Group E : Financial Mathematics (Marks : 10)	2 questions are to be attempted out of 4 questions each carrying 5 marks.

Evaluation of Tutorial (TU : 1 credit, 25 marks)

(a) An Internal examination of 15 marks should be conducted by the Colleges.
Questions of 3 marks / 5 marks / 6 marks covering the whole syllabus should be prepared for the purpose of internal examination.

(b) 10 marks should be awarded based on Viva-Voce eamination conducted by the Colleges.

(c) For MTHM-SEC3-TH (Linear Programming & Rectangular Games) 10 marks will be awarded by evaluation of internal assignments instead of viva-voce.

4-yr Credit Distribution | MDC Credit Distribution | Course Overview
Major | Minor | MDC | Question Pattern