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UNIVERSITY OF CALCUTTA · CCF (NEP 2020) UG SYLLABUS

Mathematics Minor · Semester 4

Semester-wise syllabus · Minor stream · MMTH-MN papers

What this file contains

- MMTH-MN-2: Basic Algebra (Semester 2 or 4)
- Course structure page and question pattern

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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More semester-wise syllabus files and question papers: palmaths.com/cu-pyqs/

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**.

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

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.

References

[1] Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, 2nd Ed., Springer Nature, 2014.

[2] W. S. Burnside and A.W. Panton, Theory of equations, Dublin University Press Series, S. Chand & Co., Pvt. Ltd., 1986.

[3] Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.

[4] Anton Howard and Chris Rorres, Elementary Linear Algebra with Supplemental Applications, 11th Ed., Wiley, 2014.

[5] K. Hoffman, R. Kunze, Linear algebra, Prentice Hall India Learning Pvt. Ltd., 2015.

[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

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.