

DEPARTMENT OF MATHEMATICS

SYLLABUS FOR FOUR YEAR UNDERGRADUATE PROGRAMME

FIRST AND SECOND SEMESTER

(APPROVED BY ACADEMIC COUNCIL VIDE RESOLUTION NO. 3, DATED: 04 – 07 – 23)



ARYA VIDYAPEETH COLLEGE (AUTONOMOUS)

ARYA NAGAR, GUWAHATI – 16

INDEX

Serial No	Content	Page No.
1	Structure of Four Year Undergraduate Course	1
2	Semester Wise Credit Distribution	2
3	List of Papers	3
4	First Semester Syllabus	4
5	Second Semester Syllabus	12

Structure of Four Year Undergraduate Course

Semester	Type	Core	Minor	SEC	IDC	AEC	VAC/FC	IN
	Credit	4	4	3	3	2	4(2 + 2)	2
I		CE-1114	MN-1114	SE-1113	ID-1113	AE-1112	VL-1112 (Two Courses)	-
II		CE-2114	MN-2114	SE-2113	ID-2113	AE-2112	VL-2112 (Two Courses)	-
III		CE-3214	MN-3214	SE-3213	ID-3213	AE-3212	-	-
		CE-3224						
IV		CE-4214	MN-4214	-	-	AE-4212	-	IN-4212
		CE-4224						
		CE-4234						
V		CE-5314	MN-5214	-	-	-	-	-
		CE-5324						
		CE-5334						
		CE-5344						
VI		CE-6314	MN-6214	-	-	-	-	-
		CE-6324						
		CE-6334						
		CE-6344						
VII		CE-7414	MN-7314	-	-	-	-	-
		CE-7424						
		CE-7434						
		CE-7444						
VIII		CE-8414	MN-8314	-	-	-	-	-
		CE-8424**						
		CE-8434**						
		CE-8444**						

****Students who secure more than 7.5 CGPA at the end of third year (6th semester) may opt for a research dissertation of 12 credits instead of the three core papers.**

Course code: First two letters is the abbreviation of course component

First digit implies semester number

Second digit implies course level

Third digit implies course number

Digit	Course Level
1	100 - 199
2	200 - 299
3	300 - 399
4	400 - 499

Fourth digit implies credit points per course. Semester Wise Credit Distribution

Semester	CREDIT DISTRIBUTION							
	CORE	MINOR	SEC	AEC	IDC	VAC/FC	IN	TOTAL
FIRST	1 x 4	1 x 4	1 x 3	1 x 2	1 x 3	2 x 2	--	20
SECOND	1 x 4	1 x 4	1 x 3	1 x 2	1 x 3	2 x 2	--	20
THIRD	2 x 4	1 x 4	1 x 3	1 x 2	1 x 3	--	--	20
FOURTH	3 x 4	1 x 4	--	1 x 2	--	--	1 x 2	20
FIFTH	4 x 4	1 x 4	--	--	--	--	--	20
SIXTH	4 x 4	1 x 4	--	--	--	--	--	20
SEVENTH	4 x 4	1 x 4	--	--	--	--	--	20
EIGHT	4 x 4	1 x 4	--	--	--	--	--	20

SEC: SKILL ENHANCEMENT COURSE

AEC: ABILITY ENHANCEMENT COURSE

IDC: INTERDISCIPLINARY COURSE

VAC/FC: VALUE ADDED COURSE

IN: INTERNSHIP

Abbreviation of Course Components:

CE (Core), MN (Minor), SE(Skill Enhancement Course), AE (Ability Enhancement Course), VL (Value added Course), ID (Interdisciplinary Course), IN (Internship)

LIST OF PAPERS:

CORE:

1. Algebra (MT-CE-1114)
2. Calculus (MT-CE-2114)

MINOR:

1. Algebra (MT-MN-1114)
2. Calculus (MT-MN-2114)

SKILL ENHANCEMENT COURSE:

1. Computer Algebra (MT-SE-1113)
2. LaTeX (MT-SE-2113)

MULTIDISCIPLINARY/INTERDISCIPLINARY COURSE:

1. Mathematical Aptitude (MT-ID-1113)
2. Sets and Numbers (MT-ID-2113)

FIRST SEMESTER

PAPER NAME: Algebra

PAPER CODE: MT - CE - 1114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

COURSE OBJECTIVES:

Algebra is the study of operations and their applications to solving system of equations. This course intends to introduce students to the basic concepts of the theory of equations, the complex numbers and also, the matrices and determinants.

COURSE OUTCOME:

This course will enable the students to:

- *Analyze a given system of equations, and tell the nature of the roots of the given system.*
- *Apply De Moivre's theorem as and when applicable.*
- *Learning the basic operations in matrices, and hence check the consistency of a given system of equations. Also, solve both homogeneous and non-homogeneous system of equations.*

Unit1:Theory of Equations (Lectures: 15)

General properties of equations, Theorems related to real roots of equations, Existence of a root in the general equation, Imaginary roots, Equal roots, Theorems determining the number of roots of an equation, Relation between roots and coefficients of n^{th} degree equation, solution of cubic and bi-quadratic equations.

Unit 2: Complex Numbers(Lectures: 10)

De Moivre's theorem (both integral and rational index), Roots of complex numbers, Solutions of equations using trigonometry and De Moivre's theorem.

Unit3:Matrix: (Lectures: 20)

Matrix Algebra, Transposition, Symmetry, Matrix inversion and properties, Row Echelon form and Rank of a matrix, Reduced row Echelon form, Consistency of linear systems, Solutions of system of homogeneous and non-homogeneous linear equations with number of equations and unknowns up to four. Invariance of rank under elementary transformations, Reduction to normal form.

BOOKS RECOMMENDED:

1. Gilbert, L.&Gilbert,J.,*Elements of Modern Algebra*,(8thEdition), Cengage Learning, 2013.
2. Burnside, W.S.&Panton,ArthurW., *The Theory of Equations*,Vol.1(8thEdition),Dublin University Press Series.
3. Meyer, C.D., *Matrix Analysis and Applied Linear Algebra*. Society for Industrial and Applied Mathematics (Siam), 2000.

REFERENCEBOOKS:

1. Dickson,L.E.,*First Coursein The Theory of Equations*. The Project Gutenberg eBook(<http://www.gutenberg.org/ebooks/29785>), 2009.
2. Gilbert,W.J., *Modern Algebra with Applications* (2nd ed.).John Wiley & Sons, 2004.
3. Andreescu, T. and Andrica, D., *Complex Numbers from A to Z*, Birkhauser, 2006.

PAPER NAME: Algebra

PAPER CODE: MT - MN - 1114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

COURSE OBJECTIVES:

Algebra is the study of operations and their applications to solving system of equations. This course intends to introduce students to the basic concepts of the theory of equations, the complex numbers and also, the matrices and determinants.

COURSE OUTCOME:

This course will enable the students to:

- *Analyze a given system of equations, and tell the nature of the roots of the given system.*
- *Apply De Moivre's theorem as and when applicable.*
- *Learning the basic operations in matrices, and hence check the consistency of a given system of equations. Also, solve both homogeneous and non-homogeneous system of equations.*

Unit1:Theory of Equations (Lectures:15)

General properties of equations, Theorems related to real roots of equations, Existence of a root in the general equation, Imaginary roots, Equal roots, Theorems determining the number of roots of an equation, Relation between roots and coefficients of n^{th} degree equation, solution of cubic and bi-quadratic equations.

Unit 2: Complex Numbers (Lectures:10)

De Moivre's theorem (both integral and rational index), Roots of complex numbers, Solutions of equations using trigonometry and De Moivre's theorem.

Unit3:Matrix: (Lectures: 20)

Matrix Algebra, Transposition, Symmetry, Matrix inversion and properties, Row Echelon form and Rank of a matrix, Reduced row Echelon form, Consistency of linear systems, Solutions of system of homogeneous and non-homogeneous linear equations with number of equations and unknowns up to four. Invariance of rank under elementary transformations, Reduction to normal form.

BOOKS RECOMMENDED:

1. Gilbert, L.&Gilbert,J.,*Elements of Modern Algebra*, (8thEdition), Cengage Learning, 2013.
2. Burnside, W.S. & Panton, Arthur W., *The Theory of Equations*, Vol.1(8thEdition),Dublin University Press Series.
3. Meyer, C.D., *Matrix Analysis and Applied Linear Algebra*. Society for Industrial and Applied Mathematics (Siam), 2000.

REFERENCE BOOKS:

1. Dickson,L.E.,*First Course in The Theory of Equations*. The Project Gutenberg eBook(<http://www.gutenberg.org/ebooks/29785>), 2009.
2. Gilbert,W.J., *Modern Algebra with Applications* (2nd ed.).John Wiley&Sons, 2004.
3. Andreescu, T. and Andrica, D., *Complex Numbers from A to Z*, Birkhauser, 2006.

PAPER NAME: Computer Algebra

PAPER CODE: MT – SE – 1113

Total Credits: 3 (Theory: 2 + Practical/Tutorial: 1)

THEORY

Total Lectures: 30

COURSE OBJECTIVES:

Through this course, students can understand the basic applications of Algebra and Trigonometry using the Mathematica software. Emphasis is given on the plotting of graphs, both in two and three dimensions and also on working with matrices.

COURSE OUTCOME:

This course will enable the students to

- i) Learn to plot graphs of various functions using Mathematica Software.*
- ii) Learn to solve various equations like trigonometric equation, transcendental equation using Mathematica Software.*
- iii) Acquire basic knowledge of algebra, trigonometry and calculus through Mathematica Software.*

Unit 1: Algebra and Trigonometry: (Lectures: 10)

Polynomials, Rational and Algebraic functions, Trigonometric functions, Solving Trigonometric, Algebraic and Transcendental equations.

Unit 2: Plotting of Graph of functions: (Lectures: 10)

Computing and plotting functions in 2D, plotting functions of two variables using Plot 3D and Contour Plot, plotting parametric curves surfaces, customizing plots, animating plots.

Unit 3: Matrices: (Lectures: 10)

Simple programming in a CAS, working with matrices, Performing Gauss elimination, operations (transpose, determinant, inverse), Minors and cofactors, working with large matrices.

PRACTICAL:

CREDITS:1 (LECTURES: 30)

1. Plotting the graphs of the following functions: ax , $[x]$ (greatest integer function), $|ax + b|$, $\sqrt{ax + b}$, $\sqrt{ax + b} \pm c$, $x^{\pm n}$, $x^{\frac{1}{n}}$, $\text{Sin}(ax + b)$, $\text{Cos}(ax + b)$, $|\text{Sin}(ax + b)|$, $|\text{Cos}(ax + b)|$, $\log x$.

Observe and discuss the effect of changes in the real constants a , b and c on the graphs.

2. Sketching parametric curves, e.g., Trochoid, Cycloid, Epicycloid and Hypocycloid.
3. Tracing of conic in Cartesian coordinates.
4. Obtaining surface of revolution of curves.
5. Obtain transpose, determinant, minors, cofactors and inverse of a large square matrix.

BOOKS RECOMMENDED:

1. Bindner, D. & Erickson, M., *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*, CRC Press, Taylor & Francis Group, LLC, 2011.
2. Torrence, B. F., & Torrence, E. A., *The Student's Introduction to Mathematica: A Handbook for Pre calculus, Calculus, and Linear Algebra* (2nd ed.), Cambridge University Press, 2009.

TextBook:

1. Don, E., *Mathematica* (Second Edition), Schaum's Outline series, Mc Graw

PAPER NAME :Mathematical Aptitude

PAPER CODE : MT – ID – 1113

TOTAL CREDITS : 3 (Theory: 3)

THEORY

Total Lectures :45

COURSE OBJECTIVE:

The main objective of this course is to grow interest in mathematics, to recognize that mathematics permeates the world around us and to appreciate the usefulness, power and beauty of mathematics. Studying Mathematics also develop patience and persistence when solving problems. It also develops fundamental skills like logical reasoning, critical thinking among the students.

COURSE OUTCOME :

This course helps the students to develop logical and problem-solving skills and thus help them to prepare for different competitive examinations.

Unit 1:Mathematical Aptitude (Lectures: 15)

Fraction, Average, Time and Distance, Ratio, Proportion and Percentage, Profit and loss, Interest (Simple and Compound) and discounting, Share and Stocks.

Unit 2:Mensurations(Lectures: 15)

Area, Perimeter, Volume and Surface Area of Geometric Shapes.

Unit 3: Data Interpretation(Lectures: 10)

Classification and representation of Data, Tabulation, Mean, Median, Mode, Pi-Diagram and Bar diagram.

Unit 4: Reasoning and Aptitude(Lectures: 5)

Logical reasoning, Series, mirror image, figure matrix, Cubes and Dice, Coding-Decoding, Puzzles, Blood relation test and patterns.

SECOND SEMESTER

PAPER NAME: Calculus

PAPER CODE: MT - CE - 2114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

COURSE OBJECTIVES:

Calculus is the mathematical study of 'change'. This course intends to introduce students to the significant concepts of limit, continuity and differentiability of real valued functions. Also, students will acquire the knowledge of solving complicated integrals using reduction formulae and hence, able to evaluate arc length, surface area and volume.

COURSE OUTCOME:

The students who take this course will be able to:

- i) Learn about basic concepts of real sequences.*
- i) Understand concepts of limit and continuity of functions.*
- ii) Learn about differentiability of a function, and understand the various applications of real valued functions.*
- iii) Apply reduction formulae to solve complicated integrals, and also to apply them in the real world problems.*

Unit1: Real Sequences (Lectures: 5)

Sequences, Limit of a sequence, Monotone sequences.

Unit 2: Limits and continuity(Lectures: 15)

Limit and continuity of a function , Properties of continuous functions including Intermediate Value Theorem.

Unit2:Differentiability(Lectures: 15)

Differentiability, Successive differentiation, Recursion formulae using Leibnitz theorem, Rolle's theorem, Lagrange's mean value theorem, Taylor's theorem, Taylor's series and Maclaurin's series.

Unit 3: Application of Integration (Lectures:10)

Volumes by slicing, disks and washers' methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

BOOKS RECOMMENDED:

1. Anton, H., Bivens, I., & Davis, S., *Calculus* (10th ed.). John Wiley & Sons Singapore Pte. Ltd. Reprint by Wiley India Pvt. Ltd. Delhi, 2013, 2016.
2. Narayan, S. and Mittal, P. K.; *Differential Calculus*, S. Chand, 2005.

REFERENCE BOOKS:

1. Strauss, M. J., Bradley G. L. and Smith K. J., *Calculus* (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
2. Bradley, G. L. and Smith, K. J., *Calculus*, Prentice Hall Inc, (1st Edition) 1995.
3. Thomas, Jr. G. B., Weir, M. D., & Hass, J., *Thomas' Calculus* (13th ed). Pearson Education, Delhi. Indian Reprint 2017, 2014.

PAPER NAME: Calculus

PAPER CODE: MT - MN - 2114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

COURSE OBJECTIVES:

Calculus is the mathematical study of 'change'. This course intends to introduce students to the significant concepts of limit, continuity and differentiability of real valued functions. Also, students will acquire the knowledge of solving complicated integrals using reduction formulae and hence, able to evaluate arc length, surface area and volume.

COURSE OUTCOME:

The students who take this course will be able to:

- i) Learn about basic concepts of real sequences.*
- i) Understand concepts of limit and continuity of functions.*
- ii) Learn about differentiability of a function, and understand the various applications of real valued functions.*
- iii) Apply reduction formulae to solve complicated integrals, and also to apply them in the real world problems.*

Unit1: Real Sequences (Lectures: 5)

Sequences, Limit of a sequence, Monotone sequences.

Unit 2: Limits and continuity(Lectures: 15)

Limit and continuity of a function ,Properties of continuous functions including Intermediate Value Theorem.

Unit2: Differentiability(Lectures: 15)

Differentiability, Successive differentiation, Recursion formulae using Leibnitz theorem, Rolle's theorem, Lagrange's mean value theorem, Taylor's theorem, Taylor's series and Maclaurin's series.

Unit 3: Application of Integration (Lectures:10)

Volumes by slicing, disks and washers' methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

BOOKS RECOMMENDED:

3. Anton, H., Bivens, I., & Davis, S., *Calculus* (10th ed.). John Wiley & Sons Singapore Pte. Ltd. Reprint by Wiley India Pvt. Ltd. Delhi, 2013, 2016.
4. Narayan, S. and Mittal, P. K.; *Differential Calculus*, S. Chand, 2005.

REFERENCEBOOKS:

1. Strauss, M. J., Bradley G. L. and Smith K. J., *Calculus* (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
2. Bradley, G. L. and Smith, K. J., *Calculus*, Prentice Hall Inc, (1st Edition) 1995.
3. Thomas, Jr. G. B., Weir, M. D., & Hass, J., *Thomas' Calculus* (13th ed). Pearson Education, Delhi. Indian Reprint 2017, 2014.

PAPER NAME: LaTeX

PAPER CODE: MT -SE-2113

Total Credits: 3 (Theory: 2 + Practical/Tutorial: 1)

THEORY

Total Lectures: 30

COURSE OBJECTIVES:

The course aims to familiarize students with typesetting software LaTeX which will enable them to prepare documents especially with mathematical equations, graphs and figures. This course will also acquaint them with the Beamer presentation techniques.

COURSE OUTCOME:

After studying this course the student will be able to:

- a. Create and typeset a LaTeX document.
- b. Typeset a mathematical document using LaTeX.
- c. Learn about creating simple pictures using LaTeX.
- d. Create a beamer presentations.
- e. Learn LaTeX through overleaf.
- f. Assamese writing using LaTeX.

Unit 1: Elements of LaTeX(Lectures: 15)

Typing a LaTeX document, typing a mathematical document.

Unit 2: Graphics in LaTeX(Lectures: 10)

Creating simple pictures, PS Tricks.

Unit 3: Beamer (Lectures: 5)

Beamer presentation, LaTeX through Overleaf, LaTeX in Assamese Language writing.

PRACTICAL: (Lectures: 30) LATEX Programmes based on the theory above

BOOKS RECOMMENDED:

1. Erickson, M. J. and Bindner, D., *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*, CRC Press, Boca Raton, FL, 2011.

REFERENCE BOOKS:

1. Lamport, L., *LATEX: A Document Preparation System, User's Guide and Reference Manual*. Addison-Wesley, New York, second edition, 1994.

PAPER NAME: Sets And Numbers

PAPER CODE : MT – ID – 2113

TOTAL CREDITS : 3 (Theory: 3)

THEORY

Total Lectures: 45

COURSE OBJECTIVE:

The main objective of this course is to grow interest in mathematics, to recognize that mathematics permeates the world around us and to appreciate the usefulness, power and beauty of mathematics. Studying Mathematics also develop patience and persistence when solving problems. It also develops fundamental skills like logical reasoning, critical thinking among the students.

COURSE OUTCOME:

After studying this course the students will

- i) Learn about the presence of sets in the world around us.*
- ii) Learn about Complex number system.*
- iii) Develop the ability to think logically, analyse, reason etc.*

Unit 1: Sets (Lectures: 15)

Sets and their representations, empty set, finite and infinite sets, equal sets, subsets, power set, Universal set, Venn diagrams, union and intersection of sets, difference of sets , complement of a set, Cartesian product of two sets.

Unit 2: Complex Numbers (Lectures: 15)

Introduction, Complex numbers, Algebra of complex numbers, modulus and the conjugate of a complex number, Argand Plane and polar representations.

Unit 3: Mathematical Reasoning(Lectures: 15)

Introduction, Statements, New statements from old, Special words/phrases, Implications, Validating Statements.