Darrang College (Autonomous), Tezpur-784001

Syllabus for FYUGP Mathematics (Minor)

Approved by :

Board of Studies meeting held on 28th July, 2025

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Academic Council vide Resolution no. 04, dated- 12/08/2025

Aims of Four Year Under Graduate Programme in Mathematics is to foster a comprehensive understanding and appreciation of Mathematics through innovative teaching, research and application, equipping students with the skills to solve real world problems and advance in their academic and professional pursuits.

Program Outcome: The completion of the FYUGP shall enable a student to:

- Communicate mathematics effectively by oral, written, computational and graphic means
- Create mathematical ideas from basic axioms
- Gauge the hypothesis, theorems, techniques and proofs provisionally
- Utilize mathematics to solve theoretical and applied problems by critical understanding, analysis and synthesis
- Identify applications of mathematics in other disciplines and in the real world, leading to enhancement of career prospects in a plethora of fields.
- Appreciate the requirement of lifelong learning through continued education and research.

Teaching learning process: The Department of Mathematics at Darrang College (Autonomous) is primarily responsible for organizing the Bachelor of Science/ Bachelor of Arts course with Major in Mathematics. Tutorial and practical related instructions are provided by the respective registering units under the general guidance of Department of Mathematics. There shall be 90 instructional days excluding examination in a semester.

Teaching learning tools: Teaching Learning Tools involves:

- Green-board teaching
- ICT tools- Projector, smart board etc.
- Course-based practical work using Desktop/Laptop computers.
- Along with these there are viva-voce, mock test, demonstration, presentation, classroom tests, and assignments.

The achievement of course is described in each course papers as learning outcomes in detail.

Evaluation/assessment:

The students registered for academic program will study Semester I to VIII at the Darrang College (Autonomous) and during these semesters Major, Minor and SEC courses are offered.

- English shall be the medium of instruction and examination for Major courses and English/Assamese for Minor courses.
- Examinations shall be conducted at the end of each Semester as per the Academic calendar notified by the Darrang College (Autonomous).
- The assessment broadly comprises of Internal Assessment (Sessional Examination, Assignments Presentation/Viva-Voce/Group Discussion, Attendance,) and End Semester Examination.
- Theory papers without practical/presentation consist of total 100 marks divided into 60 marks for theory, 40 marks for internal assessment.
- Theory papers with practical/presentation and Skill Enhancement Courses consists of total 100 marks divided into 60 marks for theory, 20 marks for internal assessment and 20 marks for Practical/Presentation.
- Internal assessment of 40 marks is comprises with 20 marks from sessional examination, 10 marks from assignment, 06marks for Presentation/Viva-Voce/Group Discussion and 4 marks from attendance (4 marks for above 75% attendance).
- Each practical paper will carry 30 marks including 25 marks for continuous evaluation and 2 marks for practical note book and 3 marks for the oral test or viva voce. Hardcopy of practical file has to be maintained by the students for each practical paper and has to be submitted in the concerned department at the time of examination
- Each presentation will carry 20 marks including 15 marks for continuous evaluation and 2 marks for presented report and 3 marks for the oral test or viva voce. The departments will decide the process of continuous evaluation for the task carried-out against the presentation. Hardcopy of the report has to be maintained by the students for each presented paper and has to be submitted in the concerned department at the time of examination.

Course Structure:

The program is a four year course divided into eight semesters. A student is required to complete 176 credits for the completion of course and the award of degree as Major student.

- 4 credit papers = 100 marks (60T+20IA+20P with practical)/ (60T+40IA without practical)
- Question pattern: ➢ For 100 marks papers (60T+40IA) [1 marks× 8 (no options), 2 marks × 6(10 options), 5 marks × 4 (8 options), 10 marks × 2 (5 options)]
- For 75 marks papers (45T+30P) [1 marks× 4 (no options), 2 marks × 3(no options), 5 marks × 3 (6 options), 10 marks × 2 (5options)]

CURRICULUM COMPONENTS

- **Distribution of Credits in first 3 years:**

Sl No.	**Type**	**Credit**
1	Major 15 x 4	60
2	Minor 06 x 4	24
3	SEC 3+3+3	09

- 1 CREDIT = 15 hours (one hour of classroom instruction per week)

*Skill-based courses may be worked out in line with the UGC guidelines under National Skill Qualification Framework (NSQF)/ National Credit Framework (NCrF)

- **B. A. / B.Sc Course distribution for first year**

Year	**Semester**	**Course Code**	**Title of the course**	**Credit**
	1st Semester	MAT-MJ-01014	Algebra	4
		MAT-MN-01014	Algebra	4
		MAT-SEC-01013 (Major oriented)*	MS Power Point and LaTeX	3
		VAC	--	2

1st Year		MDC	--	3
		AEC	--	4
	Total	**--**	**--**	**20**
	2nd Semester	MAT-MJ-02014	Calculus	4
		MAT-MN-02014	Calculus	4
		MAT-SEC-02013 (Major oriented)*	Programming in C	3
		VAC	--	2
		MDC	--	3
		AEC	--	4
	Total	**--**	**--**	**20**

FOUR YEAR UNDERGRADUATE PROGRAMME IN MATHEMATICS
SEMESTER-I

Title of the course	Algebra
Course code	MAT-MN-01014
Nature of Course	Minor
Total Credit	04 (Theory: 04 + Practical: 00)
Contact Hours	60
Total Marks	100 (End Term: 60, Internal Assessment: 40)

Course Objectives: The primary objective of this course is to explain students about the general structure of equations, complex numbers, matrices, basic concepts of set theory. Furthermore, fundamental concepts of mathematical logic and reasoning will be taught to them.

Learning Outcome: This course will enable the students to:

- Employ De Moivre's Theorem in a number of applications to solve numerical problems.
- Determine the number of positive/negative real roots of a real polynomial using Descartes' rule of sign, also, learn about symmetric functions of the roots for cubic and biquadratic equations.
- Learn how to solve cubic equations.
- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, also, finding inverse and rank of a matrix.
- Learn the basics of set theory including partial order relation, countability of sets.
- Learn how to deal with mathematical statements which are composite or with quantifiers, also, statements with implications.

Unit	Content	L	T	P	Total Hrs
I	**Complex Numbers and Theory of Equations:** **Complex Numbers**: Polar representation of complex numbers, De Moivre's Theorem (both integral and rational index) and its applications, Roots of a complex number, n^{th} roots of unity. **[1]** Chapter:2 (Sections 2.7-2.11) **(10 Marks)**	10	02	--	12
	Theory of Equations: Polynomial and Polynomial Equations, Deduction from Fundamental Theorem of Classical Algebra, Descartes' rule of signs, Relation between roots and coefficients of	12	02	--	14

	a polynomial equation of degree n, Symmetric functions of roots for cubic and biquadratic equations, Transformation of equations, Cardan's method of solution of a cubic equation. **[1]** Chapter: 5 (Sections: 5.1, 5.3.4, 5.4, 5.5, 5.6 upto 5.6.3, 5.11.2) **(15 Marks)**				
II	**Matrices:** Elementary operations on a matrix, Matrix inversion and properties, Rank of a matrix, Determination of rank by reduction into echelon form & normal form, Symmetric matrix, Hermitian matrix, Elementary matrices and equivalence Consistency of linear systems, Solutions of system of homogeneous linear equations. **[2]** Chapter: 3 (Sections: 3.7), Chapter: 2 (Sections: 2.1 to 2.4) **(15 Marks)**	12	02	--	14
III	**Basics of set theory:** Partial order relation, poset, chain, upper and lower bounds in poset, greatest element and least elements, maximal and minimal elements, supremum and infimum, Zorn's Lemma, Finite and infinite sets, countable and uncountable sets. **[3]** Chapter:6 (Sections: 6.2, 6.3), Chapter: 7 (Sections: 7.1, 7.2) **(10 Marks)**	08	02	--	10
IV	**Mathematical Statement and Logic:** Mathematical statement, Statement with quantifiers "*there exists"* and *"for every*", Compound statement using *"or"* and *"and",* Statements with implications: *"if-then"* statement and *"if and only if"* statement, Contra-positive statement, The Induction Principle,. **[3]** Chapter: 1(Sections: 1.1, 1.2 upto Exercise 1.2.13, 1.3 up-to Exercise 1.3.8, 1.4), Chapter: 5 (Section: 5.1) **(10 Marks)**	09	01	--	10

Text Books:

4. Mappa, S.K., (2011). *Higher Algebra (Classical)* (Revised 8th Edition), Levant Books.
5. Meyer, Carl .D., (2000). *Matrix Analysis and Applied Linear Algebra*, Society for Industrial and Applied Mathematics (Siam). https://vik.wiki/images/2/21/FmLinalg_jegyzet_2000_Meyer.pdf
6. Kumar, A., Kumaresan, S. and Sarma, B.K., (2018*). A Foundation Course in Mathematics*, Narosa.

Reference Books:

4. Andreescu, T. and Andrica, D., (2014). *Complex numbers from A to...Z.* (2nd Edition), Birkhäuser.
5. Dickson, Leonard E., (2009). *First Course in the Theory of Equations,* John Wiley & Sons, Inc. The Project Gutenberg, eBook: http://www.gutenberg.org/ebooks/29785.
6. Halmos, P. R., (2009). *Naive Set Theory,* Springer.

FOUR YEAR UNDERGRADUATE PROGRAMME IN MATHEMATICS

SEMESTER-II

Title of the course	Calculus
Course code	MAT-MN-02014
Nature of Course	Minor
Total Credit	04 (Theory: 04 + Practical: 00)
Contact Hours	60
Total Marks	100 (End Term: 60, Internal Assessment: 40)

Course Objectives: The primary objective of this course is to develop a deep and rigorous understanding of real analysis including convergence and divergence of sequences and series of real numbers, also understand the quantitative change in the behavior of the variables and apply basic tools of calculus which are helpful in understanding their applications in many real world problems.

Learning Outcome: This course will enable the students to:

- Understand many properties of the real line R, including completeness and Archimedean properties.
- Learn to define sequences in terms of functions from N to a subset of R.
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply limit comparison tests for convergence of an infinite series of real numbers.
- Understand continuity and differentiability in terms of limits.
- Describe asymptotic behavior in terms of limits involving infinity.
- Compute the reduction formulae.
- Apply the concepts of asymptotes and inflexion point in tracing of curves.

UNIT	CONTENT	L	T	P	Total Hrs
I	**Basic concepts of real numbers:** Algebraic and order properties of R, absolute value and real line, bounded sets, supremum and infimum, completeness property of R, the Archimedean property, the density theorem. **[1]** Chapter:2 (Sections 2.1-2.4) **(10 Marks)**	09	01	--	10

II	**Sequence and Series:** Real sequences, limit of a sequence, convergent sequence, bounded sequence, Limit theorems, monotone sequences, Monotone convergence theorem, Subsequences and the Bolzano Weierstrass theorem, monotone subsequence theorem, Cauchy sequences, Cauchy's convergence criterion, properties of divergence sequences, Introduction to series. **[1]** Chapter:3 (Sections 3.1 to 3.7) **(15 Marks)**	13	02	--	15
III	**Limits, Continuity and Differentiability :** Limit of a function, Continuity and types discontinuities. Differentiability of a function, Successive differentiation: Calculation of the nth derivatives, Leibnitz theorem, Partial differentiation, Euler's theorem on homogeneous functions, Infinite limits, Indeterminate forms. [**1**] Chapter 1, Chapter 3 (Sections 3.2, 3.3 and 3.6), and Exercise 26, page 184 **[2]** Chapter 10 **[4]** Chapter 12 (Section 12.3) and Chapter 2 (Section 2.5) **(15 Marks)**	13	02	--	15
IV	**Reduction formulae and Tracing of Curves:** Reduction formulae: Reduction formulae for and their applications. **[3]** Chapter 4 (Sections 4.1 – 4.6) (**10 Marks)**	09	01	--	10
	Tracing of Curves: Asymptotes, Concavity and inflexion points, Singular points, Tangents at the origin and nature of singular points, Curve tracing (cartesian and polar equations) **[4]** Chapter 9 (Sections 9.1, 9.2 and 9.9 (Polar curves only), Chapter 11 **(10 Marks)**	09	01	--	10

Text books:

6. Bartle, R. G. and Sherbert, D. R., (2002). *Introduction to Real Analysis* (3rd Edition), JohnWiley and Sons. https://sowndarmath.wordpress.com/wp-content/uploads/2017/10/real-analysis-by-bartle.pdf
7. Anton, H., Bivens, I. and Davis, S. F., (2013). *Calculus (*10th Edition). John Wiley & Sons Singapore Pte. Ltd. Reprint (2016) by Wiley India Pvt. Ltd. Delhi.

https://3lihandam69.wordpress.com/wp-content/uploads/2018/10/calculus-10th-edition-anton.pdf

8. Narayan, S. and Mittal, P.K., (2005). *Differential Calculus*, S. Chand.

9. Narayan, S. and Mittal, P.K., (2007). *Integral Calculus*, S. Chand.
10. Gorakh, P., (2016). Differential Calculus (19th Edition), Pothishala Pvt. Ltd. Allahabad.

Reference book:

3. Kumar, A. and Kumaresan, S., (2014). *Basic Course in Real Analysis*, CRC Press.
4. Thomas Jr,. G. B., Weir, M. D., and Hass, J., (2014). *Thomas' Calculus* (13th Edition), Pearson. https://rodrigopacios.github.io/mrpacios/download/Thomas_Calculus.pdf