



Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Four Year B.Sc. Degree Program in Mathematics

(Faculty of Science & Technology)

CBCS Syllabus

F.Y.B.Sc. (Mathematics) Semester -I

For Department of Mathematics

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

Title of the Programme: F.Y.B.Sc. (Mathematics)**Preamble**

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Mathematics and related subjects, the Board of Studies in Mathematics at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of F.Y.B.Sc. Mathematics, which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

A Mathematics degree equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Graduates in Mathematics find opportunities in various fields, including Financial Planner, Market Research Analyst, Data Scientist, teaching, Insurance underwriter, operations research analyst, software developer, and many other domains. After graduating with a degree in mathematics, students can embark on a

multitude of rewarding and diverse career paths. The analytical and problem-solving skills honed during their studies equip them with a strong foundation for success in various fields. Many graduates choose to pursue careers in academia and research, where they can contribute to the advancement of mathematical knowledge through teaching, publishing papers, and conducting ground breaking research. Others may opt for careers in the financial sector, such as investment banking or actuarial science, utilizing their expertise in mathematical modelling and statistical analysis to make informed decisions and manage risks. Additionally, the field of data science offers abundant opportunities for mathematics graduates, as they possess the ability to extract meaningful insights from complex data sets and develop algorithms that drive innovation in industries like technology, healthcare, and marketing. Moreover, mathematics graduates can find fulfilling careers in engineering, cryptography, software development, and operations research, to name just a few areas where their mathematical skills are highly sought after. Overall, a degree in mathematics opens doors to a wide range of intellectually stimulating and financially rewarding professions, allowing graduates to make significant contributions to society and thrive in a rapidly evolving world.

Overall, revising the Mathematics syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Specific Outcomes (PSOs)

PSO 1-Proficiency in Mathematical Concepts: Graduates will have a deep understanding of fundamental mathematical concepts and theories across various branches of mathematics, including calculus, algebra, geometry, probability, and statistics.

PSO 2-Problem-Solving Skills: Graduates will possess strong problem-solving skills and the ability to apply mathematical principles to real-world situations. They can analyze complex problems, develop logical reasoning, and devise creative strategies to find solutions.

PSO 3-Mathematical Modeling: Graduates will be proficient in mathematical modeling, which involves using mathematical techniques to describe and analyze real-world phenomena. They can formulate and solve mathematical models to address problems in diverse fields, including physics, economics, engineering, and social sciences.

PSO4-Computational and Analytical Skills: Graduates will be skilled in using computational tools and software, such as programming languages, statistical software, and mathematical modeling software. They can leverage these tools to perform numerical analysis, data visualization, and simulations.

PSO 5-Communication and Presentation: Graduates will possess effective communication skills, both written and oral, to convey complex mathematical ideas and results to both technical and non-technical audiences. They can present mathematical arguments, proofs, and findings in a clear and concise manner.

PSO 6-Research and Inquiry: Graduates will have the ability to engage in mathematical research and inquiry. They can critically evaluate existing mathematical theories, develop new mathematical models, and contribute to the advancement of mathematical knowledge through independent research or collaborative projects.

PSO 7-Interdisciplinary Collaboration: Graduates will be adept at collaborating with professionals from other disciplines, such as scientists, engineers, economists, and computer scientists. They can effectively communicate and work in multidisciplinary

teams to solve complex problems that require mathematical expertise.

PSO 8-Lifelong Learning: Graduates will have developed a strong foundation for lifelong learning in mathematics. They will have the skills to stay abreast of new developments in the field, adapt to emerging technologies and methodologies, and continue their professional growth through self-directed study or advanced academic pursuits.

PSO 9-Advanced Mathematical Techniques: Graduates will have a command of advanced mathematical techniques, such as differential equations, mathematical analysis, linear algebra, number theory, and optimization. They can apply these advanced mathematical tools to solve complex problems and contribute to specialized areas of research.

PSO 10-Mathematical Software Development: Graduates will possess programming skills and the ability to develop mathematical software or algorithms. They can design, implement, and optimize software applications that facilitate mathematical calculations, simulations, data analysis, and modeling.

PSO 11-Mathematical Education and Teaching: Graduates interested in pursuing a career in education will have the necessary skills to teach mathematics at various levels. They can design and deliver effective lessons, develop curriculum materials, and assess student progress in mathematics. They can also inspire and motivate students to develop an appreciation for the subject.

PSO 12-Mathematical Finance and Risk Analysis: Graduates with an interest in finance and economics will have specialized knowledge in mathematical finance and risk analysis. They can apply mathematical models, stochastic calculus, and statistical methods to analyze financial markets, manage investment portfolios, assess risk, and make informed financial decisions.

Anekant Education Society's
Tuljaram Chaturchand College, Baramati
(Autonomous)

Board of Studies (BOS) in Mathematics

From 2022-23 to 2024-25

Sr. No.	Name	Designation
1.	Mr. Sadashiv R. Puranik,	Chairman
2.	Ms. Varsha H. Shinde	Member
3.	Dr. Prakash B. Fulari	Member
4.	Ms. Shaila S. Jadhav	Member
5.	Ms. Nikita R. Shinde	Member
6.	Ms. Sonali V. Kate	Member
7.	Dr. Anil S. Khairnar	Vice-Chancellor Nominee
8.	Dr. Nitin S. Darkunde	Expert from other University
9.	Dr. Kishor D. Kucche	Expert from other University
10.	Mr. Amit Patil	Industry Expert
11	Dr. Haribhau R. Bhapkar	Meritorious Alumni
12.	Ms. Sharwari Markale	Student Representative
13.	Mr. Vishwajeet Nalawade	Student Representative

Credit Distribution Structure for F.Y.B.Sc.-2023-2024 (Mathematics)

Level I	Semester	Major		Minor	OE	VSC, SEC, (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr/Sem	Degree/ Cum.Cr.
		Mandatory	Electives							
4.5	I	MAT-101-MJM: Algebra (2 Credits) MAT-102-MJM: Calculus (2 Credits) MAT-103-MJM: Mathematics Practical I (2 Credits)			MAT-116-OE: Basic Mathematics I (2 Credits) MAT-117-OE: Applied Mathematics I (2 Credits)	MAT-121-VSC: Logical Methods (2 Credits)	ENG-131-AEC : Functional English-I (2 Credits)	CC1 (2 credit)	22	UG Certificate 44 credits
						MAT-126-SEC: Scilab and Maxima Software- I (2 Credits)	MAT-135-VEC: Mathematics for Environmental Science (2 Credits)			
							MAT-137-IKS: Vedic Mathematics (2 credits)			
	II	MAT-151-MJM: Geometry (2 Credits) MAT-152-MJM: Calculus and Differential Equations (2 Credits) MAT-153-MJM: Mathematics Practical II (2 Credits)		MAT-161-MJM: Fundamentals of Mathematics (2 Credits)	MAT-166-OE: Basic Mathematics II (2 Credits) MAT-167-OE: Applied Mathematics II (2 Credits)	MAT-171-VSC: Geogebra Software (2 Credits) <hr/> MAT-176-SEC: Scilab and Maxima Software- II (2 Credits)	ENG-181-AEC : Functional English-II (2 Credits) <hr/> MAT-185-VEC: Mathematical Solutions for Environmental Challenges (2 Credits)	CC2 (2 credit)	22	
Cum Cr.		12	--	2	8	8	10	4	44	

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

Course Structure for F.Y.B.Sc. Mathematics (2023 Pattern)

Sem	Course Type	Course Code	Course Name	Theory / Practical	Credits
I	Major Mandatory	MAT-101-MJM	Algebra	Theory	02
	Major Mandatory	MAT-102-MJM	Calculus	Theory	02
	Major Mandatory	MAT-103-MJM	Mathematics Practical I	Practical	02
	Open Elective (OE)	MAT-116-OE	Basic Mathematics I	Theory	02
	Open Elective (OE)	MAT-117-OE	Applied Mathematics I	Practical	02
	Vocational Skill Course (VSC)	MAT-121-VSC	Logical Methods	Theory	02
	Skill Enhancement Course (SEC)	MAT-126-SEC	Scilab and Maxima Software I	Practical	02
	Ability Enhancement Course (AEC)	ENG-131-AEC	Functional English-I	Theory	02
	Value Education Course (VEC)	MAT-135-VEC	Mathematics for Environmental Science	Theory	02
	Indian Knowledge System (IKS)	MAT-137-IKS	Vedic Mathematics	Theory	02
	Co-curricular Course (CC)	--	To be selected from the Basket	Theory	02
Total Credits Semester-I					22
II	Major Mandatory	MAT-151-MJM	Geometry	Theory	02
	Major Mandatory	MAT-152-MJM	Calculus and Differential Equations	Theory	02
	Major Mandatory	MAT-153-MJM	Mathematics Practical II	Practical	02
	Minor	MAT-161-MN	Fundamentals of Mathematics	Theory	02
	Open Elective (OE)	MAT-166-OE	Basic Mathematics II	Theory	02
	Open Elective (OE)	MAT-167-OE	Applied Mathematics II	Practical	02
	Vocational Skill Course (VSC)	MAT-171-VSC	Geogebra Software	Practical	02
	Skill Enhancement Course (SEC)	MAT-176-SEC	Scilab and Maxima Software II	Practical	02
	Ability Enhancement Course (AEC)	ENG-181-AEC	Functional English-II	Theory	02
	Value Education Course (VEC)	MAT-185-VEC	Mathematical Solutions for Environmental Challenges	Theory	02
	Co-curricular Course (CC)	--	To be selected from the Basket	Theory	02
Total Credits Semester-II					22
Cumulative Credits Semester I + Semester II					44

**CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics
(2023 Pattern)**

Name of the Programme	: B.Sc. Mathematics
Program Code	: USMT
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: Major Mandatory
Course Name	: Algebra
Course Code	: MAT-101-MJM
No. of Teaching Hours	: 30
No. of Credits	: 2

Course Objectives:

1. Define and perform basic operations on sets, including union, intersection, and complement.
2. Explain the concepts of relations, equivalence relations, and partition of sets.
3. Identify and classify different types of functions, such as one-to-one, onto, and composite functions.
4. Determine the inverse of a function and perform function composition.
5. Use the division algorithm to find quotients and remainders in integer division.
6. Apply the properties of congruences, including addition, subtraction, and multiplication.
7. Apply Fermat's theorem in solving problems involving modular arithmetic.
8. Perform arithmetic operations on complex numbers, including addition, subtraction, multiplication, and division.
9. Understand the algebraic properties of complex numbers, such as the distributive property.
10. Express complex numbers in exponential form and perform operations on them.
11. Identify and analyze different regions in the complex plane.

Course Outcomes:

By the end of the course, students will be able to:

- CO1: Understand and apply the basic concepts of sets, relations, and functions.
- CO2: Identify and use different types of functions, such as one-to-one, onto, and inverse functions.
- CO3: Analyze and solve problems using the division algorithm and the concept of greatest common divisor.
- CO4: Apply the properties of congruences and use them to solve problems.
- CO5: Understand the fundamental theorem of arithmetic and its applications.
- CO6: Perform operations on complex numbers and apply them in various contexts.
- CO7: Develop spatial reasoning skills by understanding regions in the complex plane.

Topics and Learning Points

	Teaching Hours
Unit 1: Sets, Relations and Functions	6
1.1 Sets and basic operations on sets	
1.2 Relations, Equivalence relations, Equivalence classes and Partition of sets.	
1.3 Functions, Types of functions, Inverse of a function, Composition of functions.	
Unit 2: Divisibility theory in the integers	8
2.1 Mathematical induction: Well-Ordering Principle.	
2.2 The division algorithm	
2.3 The greatest common divisor	
2.4 The Euclidean algorithm	
Unit 3: Primes and theory of congruences	8
3.1 The fundamental theorem of arithmetic	
3.2 Basic properties of congruences	
3.3 Fermat's theorem.	
3.4 Euler's phi-function (Definition and examples only) and Euler's theorem.	
Unit 4: Complex Numbers	8
4.1 Sum and product	
4.2 Basic algebraic properties	
4.3 Moduli	
4.4 Complex conjugate	
4.5 Exponential form	
4.6 Product and powers in exponential form	
4.7 Arguments of product and quotients	
4.8 Roots of complex numbers	
4.9 Regions in the complex plane	

Text Books:

1. Ajit Kumar, S. Kumaresan and Bhaba Kumar Sarma, *A Foundation Course in Mathematics*, Narosa Publication House, 2018. **Unit 1** - Sections: 2.1 to 2.5, 3.1 to 3.6, 4.1 to 4.4.
2. David M. Burton, *Elementary Number Theory*, Tata McGraw Hill, 7th Edition, 2012.
Unit 2 - Sections: 1.1, 2.2 to 2.4; **Unit 3** - Sections: 3.1, 4.2, 5.2, 7.2 and 7.3.
3. Ruel V. Churchill, James W. Brown, *Complex Variables and Applications*, McGraw-Hill, Eighth Edition.
Unit 4 - Chapter 1.

Reference Books:

1. S. K. Shah and S. C. Garg, *Textbook of Algebra*, Vikas Publishing House Pvt. Ltd.
2. Kenneth H. Rosen, *Discrete Mathematics and Its Applications*, Tata McGraw Hill.
3. Seymour Lipschutz, *Set Theory and Related Topics*, Schqum's Outline Series.
4. Robin Wilson, *Number Theory: A very short introduction*, Oxford University Press.
5. Sudarsan Nanda, *Number Theory*, Allied Publishers Pvt. Ltd.
6. Verity Carr, *Complex Numbers: Made Simple*, Made Simple Books.
7. Robert G. Bartle and Donald R. Sherbert, *Introduction to Real Analysis*, John Wiley & Sons

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem I)**Subject:** Mathematics**Course:** Algebra**Course Code:** MAT-101-MJM**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	2	2	3	2	2
PO2	2	3	3	3	2	2	1
PO3							
PO4	2	2	3	3	2	2	2
PO5	3	3	3	3	2	2	2
PO6							
PO7							
PO8	2	2	2	2	2	2	2
PO9							
PO10							
PO11							
PO12							
PO13							

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

COs require a strong grasp of theoretical concepts and principles of mathematics.

PO2: Practical, Professional and Procedural Knowledge

COs involve applying mathematical concepts and methods to practical problems and scenarios.

PO4: Specialized Skills and Competencies

COs build competencies in specialized mathematical areas and problem-solving techniques.

PO5: Capacity for Application, Problem-Solving and Analytical Reasoning

COs emphasize the application of mathematical concepts to solve problems analytically.

PO8: Learning How to Learn Skills

COs encourage self-directed learning and understanding of fundamental mathematical concepts.

**CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics
(2023 Pattern)**

Name of Programme	: B. Sc. (Mathematics)
Program Code	: USMT
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: Major Mandatory
Course Name	: Calculus
Course Code	: MAT-102-MJM
No. of Teaching Hours	: 30
No. of Credits	: 2

Course Objectives:

1. To establish the fundamental theorem and applications of single variable functions.
2. To understand real numbers and properties of real numbers.
3. To understand the infimum and supremum concepts in mathematical analysis that generalize the notions of minimum and maximum of finite or infinite sets of real numbers.
4. To understand the concept of limiting process.
5. To understand Continuity in terms of limits.
6. To understand the relationship between sequences and continuity.
7. To understand the concept of convergence and divergence of a sequence.

Course Outcomes:**By the end of the course, students will be able to:**

- CO1. Classify real numbers and recognize different properties that exist with real numbers.
- CO2. Understand the concept of supremum and infimum and their applications.
- CO3. Definition of continuity to pure and applied problems.
- CO4. Draw the graphs of algebraic and transcendental functions considering limits and continuity.
- CO5. Apply these concepts for advanced study in Mathematics (Real Analysis, Complex Analysis, topology)
- CO6. Apply limit and continuity concept in physical, chemical, and biological sciences.
- CO7. Find n terms of sequence and consider the convergence as n tends to infinity.

Topics and Learning Points

	Teaching Hours
Unit 1: Real Numbers	6
1.1 The Algebraic and Order Properties of R	
1.2 Absolute Value and the Real Line	
1.3 The Completeness Property of R	
1.4 Applications of the Supremum Property	
Unit 2. Sequences	8
2.1 Sequences and Their Limits	
2.2 Limits Theorems	
2.3 Monotone Sequences	
2.4 Subsequences and Bolzano -Weierstrass Theorem	
Unit 3. Limits	8
3.1 Functions	
3.2 Limits of Functions	
3.3 Limit Theorems	
3.4 Extension of limit concepts	
Unit 4: Continuity	8
4.1 Continuous Functions	
4.2 Continuous Functions on Intervals	

Text Books:

1. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and Sons Inc, Fourth Edition.

Unit 1: Chapter 2: Sec 2.1 (2.1.1 to 2.1.13), Sec. 2.2(2.2.1 to 2.2.9), 2.3, 2.4(2.4.1, 2.4.3 to 2.4.6, 2.4.8, 2.4.9).

Unit 2: Chapter 3: Sec. 3.1(3.1.1 to 3.1.7, 3.1.10, 3.1.11), Sec. 3.2(3.2.1 to 3.2.11), Sec. 3.3(3.3.1, 3.3.4), Sec. 3.4 (3.4.1 to 3.4.3, 3.4.5 to 3.4.8).

Unit 3: Chapter 4: Sec. 4.1(4.1.1, 4.1.3 to 4.1.9), Sec. 4.2(4.2.1 to 4.2.8), Sec. 4.3 (4.3.1 to 4.3.9). Unit 4: Chapter 5: Sec. 5.1, Sec. 5.2, Sec 5.3 (5.3.1 to 5.3.5, 5.3.7 to 5.3.10).

2. Thomas Calculus, Thirteenth Edition, Pearson Publication.

Unit 3: Text book-2: Chapter 1: Sec. 1.1.

Reference Books:

1. Introduction to Real analysis, William F.Trench, Free edition, 2010.
2. Calculus of a single variable Ron Larson, Bruce Edwards, tenth edition.
3. Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition. 4
Calculus and its Applications, Marvin L. Bittinger, David J. Ellenbogen and Scott A. Surgent, Addison Wesley, tenth edition.

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem I)**Subject:** Mathematics**Course:** Calculus**Course Code:** MAT-102-MJM**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	3	3	3	3	2
PO2	2	2	2	2	3	3	2
PO3	1	1	1	1	2	2	1
PO4	2	2	2	2	3	3	2
PO5	3	3	3	3	3	3	3
PO6	2	2	2	2	2	2	1
PO7	2	2	2	2	3	3	2
PO8	2	2	2	2	3	2	2
PO9	1	1	1	1	2	2	1
PO10							
PO11							
PO12	2	2	2	2	2	2	2
PO13							

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

Students demonstrate thorough understanding of mathematical concepts and properties of real numbers.

PO2: Practical, Professional and Procedural Knowledge

The ability to apply mathematical concepts in real-world contexts indicates practical and procedural knowledge.

PO3: Entrepreneurial Mindset and Knowledge

Basic understanding of mathematical principles does not directly relate to entrepreneurial skills.

PO4: Specialized Skills and Competencies

The application of mathematical knowledge is essential for developing specialized skills in advanced studies.

PO5: Capacity for Application, Problem-Solving and Analytical Reasoning

Students are expected to apply problem-solving skills in mathematics and related sciences effectively.

PO6: Communication Skills and Collaboration

Communicating mathematical ideas and collaborating in problem-solving is important but varies by CO.

PO7: Research-related Skills

Students develop research skills through advanced mathematical applications and understanding.

PO8: Learning How to Learn Skills

Understanding advanced concepts promotes lifelong learning and self-directed study.

PO9: Digital and Technological Skills

Limited emphasis on digital skills in basic mathematical concepts; relevance increases with applications.

PO12: Autonomy, Responsibility and Accountability

Students are encouraged to take responsibility for their learning and apply mathematical concepts independently.

**CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics
(2023 Pattern)**

Name of the Programme	: B.Sc. Mathematics
Program Code	: USMT
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: Major Mandetory
Course Name	: Mathematics Practical I
Course Code	: MAT-103-MJM
No. of Teaching Hours	: 60
No. of Credits	: 2

Course Objectives:

1. Understand the fundamental concepts of sets, relations, and functions through hands-on exercises and real-life examples.
2. Investigate the properties of prime numbers and congruences, and apply them to solve related problems.
3. Perform operations and calculations with complex numbers, and apply them in solving mathematical problems.
4. Develop proficiency in factoring and solving equations involving polynomials using appropriate methods and techniques.
5. Explore the properties and operations of matrices, and apply them to solve practical problems in various fields.
6. Familiarize students with real numbers and their properties through practical examples and exercises.
7. Investigate the properties and behavior of different sequences and series, and their applications.
8. Understand the concept of limits, evaluate them using various methods, and apply them in solving problems.
9. Analyze the concept of continuity and identify discontinuities in functions using graphical and analytical methods.
10. Develop proficiency in differentiation techniques and apply them to analyze rates of change and solve related problems.
11. Apply calculus principles to practical situations in physics, engineering, and economics, and understand their significance.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Develop a strong understanding of sets, relations, and functions.

CO2: Gain proficiency in applying divisibility theory to solve problems involving integers.

CO3: Acquire a deep knowledge of prime numbers and congruences, and their applications in various mathematical contexts.

CO4: Enhance their problem-solving skills and analytical thinking through practical applications of algebraic concepts.

CO5: Understand the concept of limits and their role in analyzing functions and their behavior.

CO6: Apply the concept of continuity and its applications in various mathematical functions and models.

CO7: Apply calculus concepts to real-world scenarios in physics, engineering, and economics.

Topics and Learning Points**Teaching Hours****Algebra Practicals:****30**

1. Exploring sets, relations and functions
2. Unravelling the secrets of divisibility of integers
3. Unveiling the mysteries of primes and congruences
4. Journey in the world of complex numbers
5. Exploring Polynomial: From factoring to solving equations
6. Discovering the power of Matrices

Calculus Practicals:**30**

1. Embarking on a journey with real numbers
2. Unravelling the fascinating world of sequences
3. Pushing the boundaries: exploring limits
4. The art of smoothness: Understanding continuity
5. The Calculus of change: Exploring derivatives and rate of change
6. Calculus in Action: Applications in Physics, Engineering and Economics

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem I)**Subject:** Mathematics**Course:** Mathematic Practical 1**Course Code:** MAT-103-MJM**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	2	2	3	2	2
PO2	2	3	3	3	2	2	1
PO3							
PO4	2	2	3	3	2	2	2
PO5	3	3	3	3	3	3	3
PO6	2	2	2	2	2	2	1
PO7	2	2	2	2	3	3	2
PO8	2	2	2	2	3	2	2
PO9	1	1	1	1	2	2	1
PO10							
PO11							
PO12	2	2	2	2	2	2	2
PO13							

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

COs require a strong grasp of practical concepts.

PO2: Practical, Professional and Procedural Knowledge

COs involve applying mathematical concepts and methods to practical problems and scenarios.

PO4: Specialized Skills and Competencies

COs build competencies in specialized mathematical areas and problem-solving techniques.

PO5: Capacity for Application, Problem-Solving and Analytical Reasoning

Students are expected to apply problem-solving skills in mathematics and related sciences effectively.

PO6: Communication Skills and Collaboration

Communicating mathematical ideas and collaborating in problem-solving is important but varies by CO.

PO7: Research-related Skills

Students develop research skills through advanced mathematical applications and understanding.

PO8: Learning How to Learn Skills

Understanding advanced concepts promotes lifelong learning and self-directed study.

PO9: Digital and Technological Skills

Limited emphasis on digital skills in basic mathematical concepts; relevance increases with applications.

PO12: Autonomy, Responsibility and Accountability

Students are encouraged to take responsibility for their learning and apply mathematical concepts independently.

**CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics
(2023 Pattern)**

Name of the Programme	: B.Sc. Mathematics
Program Code	: USMT
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: Open Elective (OE)
Course Name	: Basic Mathematics I
Course Code	: MAT-116-OE
No. of Teaching Hours	: 30
No. of Credits	: 2

Course Objectives:

1. Develop a strong understanding of whole numbers, including their properties and operations.
2. Master the basic operations on numbers, such as addition, subtraction, multiplication, and division.
3. Gain proficiency in working with integers and understand their properties and applications.
4. Acquire a solid foundation in working with fractions, including operations and simplification.
5. Learn the language of algebra, including evaluating, simplifying, and translating expressions.
6. Develop problem-solving skills by solving equations and applying prime factorization and LCM.
7. Enhance mathematical reasoning and critical thinking skills through the application of integers in equation-solving.

Course Outcomes:**By the end of the course, students will be able to:**

- CO1. Demonstrate a comprehensive understanding of whole numbers and their properties, and apply them to solve mathematical problems.
- CO2. Perform basic operations on numbers accurately and efficiently, and apply them to solve real-life problems.
- CO3. Apply the concepts of integers in various mathematical contexts, including solving equations and analyzing number patterns.
- CO4. Work proficiently with fractions, simplifying them and applying them in solving problems involving ratios and rates.
- CO5. Evaluate, simplify, and translate algebraic expressions, and solve equations using appropriate techniques.
- CO6. Apply prime factorization and LCM methods to solve problems involving integers and equations.
- CO7. Develop graphical literacy by understanding the rectangular coordinate system, graphing linear equations, and interpreting slope as a measure of rate of change.

Topics and Learning Points**Teaching Hours**

Unit 1: Numbers	6
1.1 Introduction to whole numbers	
1.2 Basic operation on numbers	
1.3 Integers	
1.4 Fractions	
Unit 2: The language of Algebra	8
2.1 Evaluate, simplify and translate expression	
2.2 Solving equations	
2.3 Prime factorization	
2.4 LCM	
2.5 Solving equations using integers	
Unit 3: Decimals and Percents	8
3.1 Decimal Operations	
3.2 Averages and Probabilities	
3.3 Ratios and rate	
3.4 Applications of percents	
Unit 4: Graphs	8
4.1 Rectangular coordinate system	
4.2 Graphing linear equations	
4.3 Understanding slope of a line	

Text Book:

Lynn Marecek, Mary Anne Anthony-Smith, *Prealgebra*, openstax

Reference Books:

1. Bobson Wong, Larisa Bukalov and Steve Slavin, *A self-teaching guide: Practical Algebra, 3rd Edition*, Wiley Publication
2. Gary S. Goldman, *Prealgebra: A practical step by step approach, 4th Edition*, Pearblossom

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem I)**Subject:** Mathematics**Course:** Basic Mathematics 1**Course Code:** MAT-116-OE**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	2	2	3	2	2
PO2	2	3	3	3	2	2	1
PO3							
PO4	2	2	3	3	2	2	2
PO5	3	3	3	3	2	2	2
PO6							
PO7	2	2	2	2	3	3	2
PO8	2	2	2	2	3	2	2
PO9	1	1	1	1	2	2	1
PO10							
PO11							
PO12							
PO13							

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

COs require a strong grasp of theoretical concepts.

PO2: Practical, Professional and Procedural Knowledge

COs involve applying mathematical concepts and methods to practical problems and scenarios.

PO4: Specialized Skills and Competencies

COs build competencies in specialized mathematical areas and problem-solving techniques.

PO5: Capacity for Application, Problem-Solving and Analytical Reasoning

COs emphasize the application of mathematical concepts to solve problems analytically.

PO7: Research-related Skills

Students develop research skills through advanced mathematical applications and understanding.

PO8: Learning How to Learn Skills

Understanding advanced concepts promotes lifelong learning and self-directed study.

PO9: Digital and Technological Skills

Limited emphasis on digital skills in basic mathematical concepts; relevance increases with applications.

**CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics
(2023 Pattern)**

Name of the Programme	: B.Sc. Mathematics
Program Code	: USMT
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: Open Elective (OE)
Course Name	: Applied Mathematics I
Course Code	: MAT-117-OE
No. of Teaching Hours	: 60
No. of Credits	: 2

Course Objectives:

1. Develop analytical and problem-solving skills through the exploration and analysis of patterns in sequences and series.
2. Enhance number sense and critical thinking by engaging in activities and games that involve playing with numbers.
3. Develop spatial visualization and geometrical reasoning skills through hands-on construction and manipulation of geometric figures.
4. Understand and apply financial mathematics concepts, including interest, investments, and budgeting, in real-life scenarios.
5. Gain a clear understanding of sets, relations, and functions, and their role in mathematical analysis and problem-solving.
6. Develop a conceptual understanding of mathematical induction and apply it to prove mathematical statements.
7. Enhance problem-solving strategies and develop mathematical thinking skills through solving a variety of mathematical problems.
8. Apply mathematical modeling techniques to real-world problems, identifying and formulating mathematical models to analyze and solve them.

Course Outcomes:**By the end of the course, students will be able to:**

CO1. Analyze and recognize patterns in sequences and series, and apply them in solving mathematical problems and real-world scenarios.

CO2. Demonstrate an enhanced understanding of number properties and relationships through engaging in activities and games involving playing with numbers.

CO3. Construct and manipulate geometric figures accurately, demonstrating spatial visualization and reasoning abilities.

CO4. Apply financial mathematics principles to make informed financial decisions and solve problems related to personal finance.

CO5. Analyze probability scenarios and calculate probabilities, making informed decisions based on mathematical reasoning.

CO6. Apply the concepts of sets, relations, and functions in analyzing mathematical problems and real-world situations.

CO7. Students will be able to employ problem-solving strategies and mathematical thinking skills to solve a wide range of mathematical problems.

Topics and Learning Points**Teaching Hours****Theory: Introduction****12**

- Integers
- Geometrical shapes
- Cartesian coordinate system
- Financial mathematics

Practicals:**48**

1. Exploring Patterns: Analyzing sequences and series
2. Playing with numbers
3. Geometry in action: Constructing and manipulating geometric figures
4. Algebraic expressions and equations
5. Financial Mathematics
6. Problems on probability
7. What is Set?
8. What is Relation?
9. What is Function?
10. Mathematical induction
11. Problem solving strategies
12. Mathematical Modelling: Applying Mathematics to real world problems

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem I)**Subject:** Mathematics**Course:** Applied Mathematics 1**Course Code:** MAT-117-OE**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	2	2	3	2	2
PO2	2	3	3	3	2	2	1
PO3							
PO4	2	2	3	3	2	2	2
PO5	3	3	3	3	2	2	2
PO6							
PO7	2	2	2	2	3	3	2
PO8	2	2	2	2	3	2	2
PO9	1	1	1	1	2	2	1
PO10							
PO11							
PO12							
PO13							

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

COs require a strong grasp of practical concepts.

PO2: Practical, Professional and Procedural Knowledge

COs involve applying mathematical concepts and methods to practical problems and scenarios.

PO4: Specialized Skills and Competencies

COs build competencies in specialized mathematical areas and problem-solving techniques.

PO5: Capacity for Application, Problem-Solving and Analytical Reasoning

COs emphasize the application of mathematical concepts to solve problems analytically.

PO7: Research-related Skills

Students develop research skills through advanced mathematical applications and understanding.

PO8: Learning How to Learn Skills

Understanding advanced concepts promotes lifelong learning and self-directed study.

PO9: Digital and Technological Skills

Limited emphasis on digital skills in basic mathematical concepts; relevance increases with applications.

**CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics
(2023 Pattern)**

Name of the Programme	: B.Sc. Mathematics
Program Code	: USMT
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: Vocational Skill Course (VSC)
Course Name	: Logical Methods
Course Code	: MAT-121-VSC
No. of Teaching Hours	: 30
No. of Credits	: 2

Course Objectives:

1. To provide student with solid foundation in basic set theory and operations of set.
2. To introduce students to propositional logic and its concepts, including propositions and their semantics.
3. To familiarize student with special relations and various types of functions.
4. To teach students operations on functions and their properties.
5. To develop students understanding of combinatorics, including counting principle and the inclusion-exclusion principle.
6. To introduce students to permutation and combination techniques.
7. To provide students with an introduction to graph theory and its fundamental concepts and properties.

Course Outcomes:**By the end of the course, students will be able to:**

CO1: Apply operations on sets to solve problems related to set theory.

CO2: Analyze and evaluate propositional logic, statements and their truth values.

CO3: Apply the concept of relations and functions to analyze and solve problems.

CO4: Perform operations on functions and demonstrate an understanding of their properties.

CO5: Solve combinatorial problems using counting principle and the inclusion-exclusion principle.

CO6: Apply permutation and combination techniques to solve problems in various contexts.

CO7: Understand and analyze graph, identify their properties and apply graph theoretical results and problem solving.

Topics and Learning Points**Teaching Hours****Unit 1: Basic Set Theory and Propositional Logic****5**

- 1.1 Operations on set
- 1.2 Proposition
- 1.3 Semantics of Propositional Logic
- 1.4 Concepts in Propositional Logic

Unit 2: Relations and Functions**6**

- 2.1 Special relations
- 2.2 Orders: partial and total
- 2.3 Types of functions
- 2.4 Operations on functions

Unit 3: Combinatorics**5**

- 3.1 Counting
- 3.2 Inclusion-exclusion principle
- 3.3 Multiplication principle
- 3.4 permutation and combination

Unit 4: Graph Theory**8**

- 4.1 Graphs
- 4.2 Properties of graphs
- 4.3 Some graph theoretic results and examples

Text Book:Roger Antonsen, *Logical Methods: The Art of Thinking Abstractly and Mathematically*, Springer

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem I)**Subject:** Mathematics**Course:** Logical Methods**Course Code:** MAT-121-VSC**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	2	2	3	2	2
PO2	2	3	3	3	2	2	1
PO3							
PO4	2	2	3	3	2	2	2
PO5	3	3	3	3	2	2	2
PO6							
PO7							
PO8	2	2	2	2	2	2	2
PO9							
PO10							
PO11							
PO12							
PO13							

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

COs require a strong grasp of theoretical concepts and principles of mathematics.

PO2: Practical, Professional and Procedural Knowledge

COs involve applying mathematical concepts and methods to practical problems and scenarios.

PO4: Specialized Skills and Competencies

COs build competencies in specialized mathematical areas and problem-solving techniques.

PO5: Capacity for Application, Problem-Solving and Analytical Reasoning

COs emphasize the application of mathematical concepts to solve problems analytically.

PO8: Learning How to Learn Skills

COs encourage self-directed learning and understanding of fundamental mathematical concepts.

**CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics
(2023 Pattern)**

Name of the Programme	: B.Sc. Mathematics
Program Code	: USMT
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: Skill Enhancement Course (SEC)
Course Name	: Scilab and Maxima Software I
Course Code	: MAT-126-SEC
No. of Teaching Hours	: 60
No. of Credits	: 2

Course Objectives:

1. Develop proficiency in performing arithmetic operations and symbolic computation in Maxima.
2. Acquire the skill to solve system of linear equations using Maxima software.
3. Gain an understanding of Calculus concepts and apply them using Maxima.
4. Develop proficiency in Matrix computation and operation using Maxima
5. Understanding basic operations and functionalities of Scilab software.
6. Explore and utilize Scilab's capabilities for trigonometric function evaluation and manipulation.
7. Develop skills in performing algebraic manipulations and simplifications using Scilab

Course Outcomes:

By the end of the course, students will be able to:

- CO1: Apply Maxima software to solve system of linear equations.
- CO2: Utilize Maxima for differentiating functions.
- CO3: Utilize Maxima for plotting and visualization capabilities.
- CO4: Apply Scilab efficiently for evaluating and manipulating trigonometric functions.
- CO5: Gain proficiency in Scilab for performing polynomial operations.
- CO6: Apply Scilab for differentiation and gain proficiency in calculating derivatives of different functions.
- CO7: Use Scilab's plotting feature to visualize mathematical functions.

Topics and Learning Points**Teaching Hours****Theory: Maxima and Scilab softwares****12**

1. Introduction to Maxima
2. Basic operations in Maxima
3. Algebraic Manipulations
4. Introduction to Scilab
5. Plotting and visualizations
6. Applications of Maxima and Scilab

Practicals:**48**

1. Arithmetic operations and symbolic computations in Maxima
2. Solving system of linear equations using Maxima
3. Calculus with Maxima
4. Matrix computations in Maxima
5. Plotting and visualization techniques in Maxima
6. Advance computation in Maxima
7. Introduction to Scilab: Environment setup and basic operations
8. Polynomial operations in Scilab
9. Exploring trigonometric function using Scilab
10. Algebraic manipulations in Scilab
11. Differentiation in Scilab
12. Plotting in Scilab

Reference Books:

1. Edwin L. Woollett, *Maxima by example: A step by step introduction to computer algebra using Maxima*
2. Tejas Sheth, Satish Annigeri and Rajesh Jakhotia, *Scilab: A practical introduction to programming and problem solving.*

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem I)**Subject:** Mathematics**Course:** Scilab and Maxima Software I**Course Code:** MAT-126-SEC**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	2	2	3	2	2
PO2	2	3	3	3	2	2	1
PO3							
PO4	2	2	3	3	2	2	2
PO5	3	3	3	3	3	3	3
PO6	2	2	2	2	2	2	1
PO7	2	2	2	2	3	3	2
PO8	2	2	2	2	3	2	2
PO9	1	1	1	1	2	2	1
PO10							
PO11							
PO12	2	2	2	2	2	2	2
PO13							

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

COs require a strong grasp of practical concepts.

PO2: Practical, Professional and Procedural Knowledge

COs involve applying mathematical concepts and methods to practical problems and scenarios.

PO4: Specialized Skills and Competencies

COs build competencies in specialized mathematical areas and problem-solving techniques.

PO5: Capacity for Application, Problem-Solving and Analytical Reasoning

Students are expected to apply problem-solving skills in mathematics and related sciences effectively.

PO6: Communication Skills and Collaboration

Communicating mathematical ideas and collaborating in problem-solving is important but varies by CO.

PO7: Research-related Skills

Students develop research skills through advanced mathematical applications and understanding.

PO8: Learning How to Learn Skills

Understanding advanced concepts promotes lifelong learning and self-directed study.

PO9: Digital and Technological Skills

Limited emphasis on digital skills in basic mathematical concepts; relevance increases with applications.

PO12: Autonomy, Responsibility and Accountability

Students are encouraged to take responsibility for their learning and apply mathematical concepts independently.

**CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics
(2023 Pattern)**

Name of the Programme	: B.Sc. Mathematics
Program Code	: USMT
Class	: F.Y.B.Sc.
Semester	: I
Course Type	: Indian Knowledge System (IKS)
Course Name	: Vedic Mathematics
Course Code	: MAT-137-IKS
No. of Teaching Hours	: 30
No. of Credits	: 2

Course Objectives:

- To introduce students to the principles and techniques of Vedic Mathematics.
- To develop students computational skills using vedic sutras
- To enhance students ability to factorize quadratic and cubic equations
- To enable students to solve equations using Vedic Mathematics methods.
- To teach students efficient methods for calculating square roots and cube roots.
- To provide students with an understanding of key theorems in Geometry using Vedic Mathematics.
- To equip students with the knowledge and skills to apply Vedic Mathematics techniques to solve real world problems.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Students will be able to demonstrate proficiency in performing arithmetical computations using vedic sutras.

CO2: Students will be able to apply Vedic methods for multiplication and division to solve numerical problems efficiently.

CO3: Students will be able to factorize quadratic and cubic expressions using Vedic methods.

CO4: Students will be able to solve simple quadratic, cubic and bi-quadratic equations using vedic mathematics.

CO5: Students will be able to calculate square roots and cube roots of numbers using vedic mathematics methods.

CO6: Students will understand and apply key theorems in Geometry such as Pythagorean theorem and Apollonius theorem using vedic mathematics.

CO7: Students will be able to solve problems in Analytical Conics using vedic mathematics techniques.

Topics and Learning Points

Unit 1: Arithmetical Computations**5**

- 1.1 Vedic Sutras
- 1.2 Multiplication
- 1.3 Division by Nikhilam Method
- 1.4 Division by Paravartya Method

Unit 2: Factorization**6**

- 2.1 Factorization of Quadratics
- 2.2 Factorization of Cubics
- 2.3 Highest Common Factor

Unit 3: Equations**5**

- 3.1 Simple Equations
- 3.2 Quadratic Equations
- 3.3 Cubic Equations
- 3.4 Bi-quadratic Equations

Unit 4: Roots**8**

- 4.1 Square root
- 4.2 Cube roots of exact cubes
- 4.3 General Cube roots

Unit 5: Geometry**6**

- 4.1 Pythagoras Theorem
- 4.2 Apollonius Theorem
- 4.3 Analytical Conics

Reference Book:

Jagadguru Sankaracarya Sri Bharati Krsna Tirthaji Maharaja, *Vedic Mathematics*, Motilal Banarasidass Publishers Private Limited, Delhi.

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem I)**Subject:** Mathematics**Course:** Vedic Mathematics**Course Code:** MAT-137-IKS**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	2	2	3	2	2
PO2	2	3	3	3	2	2	1
PO3							
PO4	2	2	3	3	2	2	2
PO5	3	3	3	3	2	2	2
PO6							
PO7							
PO8	2	2	2	2	2	2	2
PO9							
PO10							
PO11							
PO12							
PO13							

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

COs require a strong grasp of theoretical concepts in vedic mathematics.

PO2: Practical, Professional and Procedural Knowledge

COs involve applying mathematical concepts and methods to practical problems and scenarios.

PO4: Specialized Skills and Competencies

COs build competencies in specialized mathematical areas and problem-solving techniques.

PO5: Capacity for Application, Problem-Solving and Analytical Reasoning

COs emphasize the application of mathematical concepts to solve problems analytically.

PO8: Learning How to Learn Skills

COs encourage self-directed learning and understanding of fundamental mathematical concepts.