Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce, and Science College, Ahmednagar (Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

National Education Policy (NEP)
Choice Based Credit System (CBCS)

Programme Skeleton and Syllabus of
B.Sc. Mathematics (Major)

Implemented from

Academic Year 2023-24

Credit Distribution: B.Sc. Mathematics (Major) including Minor and OE and other courses.

	Type of Courses	III Yr	IV Yrs (Honours)	IV Yrs Research
Major Mathematics	Discipline-Specific Courses (DSC)	46	74	66
	Discipline Specific Elective (DSE)	08	16	16
	Skill Enhancement Courses (SEC)	06	06	06
	Vocational Skill Courses (VSC)	08	08	08
	On-Job Training (OJT)	04	08	04
	Field Project (FP)	04	04	04
	Community Engagement and Service (CEP)	02	02	02
	Research project	00	00	12
	Research Methodology	00	04	04
	Indian Knowledge System	02	02	02
	Total (I, II and III Year)	80	124	124
Minor	Minor	20	20	20
Other Courses	Open Elective (OE)/ Multidisciplinary Courses	12	12	12
	Co-Curricular Courses	08	08	08
	Ability Enhancement Courses	08	08	08
	Value Education Courses	04	04	04
	Total	132	176	176

B. Sc. Programme Framework: Credit Distribution

Year	Semester	Level	Major											Minor	OE	CC	AEC	VEC	Total
			DSC		DSE		SEC		VSC		FP/OJT/IN/CEP		IKS						
			T	P	T	P	T	P	T	P	T	P		T/P					
I	I	4.5	T	P	T	P	T	P	T	P	T	P		T/P	-	-	-	-	-
I	II	4.5	4	2	-	-	-	2	-	-	-	-	2	03	3	2	2	2	22
			6	-	-	-		2	-	2	-	-		03	3	2	2	2	22
Exit Option: Award of UG Certificate in Major with 44 credits and an additional 4 credit core NSQF course /Internship or Continue with Major and Minor																			
II	III	5.0	6	2	-	-		2	-	-	-	2		03	3	2	2	-	22
II	IV	5.0	6	2	-	-		-	-	2	-	2		03	3	2	2	-	22
Exit Option: Award of UG Diploma in Major with 88 credits and an additional 4 credit core NSQF course /Internship or Continue with major and minor																			
III	V	5.5	8	2	2	2	-	-	-	2		2		04	-	-	-	-	-	22

III	VI	5.5	6	2	2	2	-	-	-	2		4		04	-	-	-	-	-	22
Exit Option: Award of UG Degree in Major and Minor with 132 credits or continue with Major for a 4-year Degree																				
IV	VII	6.0	8	6	2	2	RM-4		-	-	-	-		-	-	-	-	-	-	-	22
IV	VIII	6.0	8	6	2	2	-	-	-	-	-	4		-	-	-	-	-	-	-	22
Four Year UG Degree(Honours) with Major and Minor with 176 credits																				
IV	VII	6.0	6	4	2	2	RM-4		-	-	-	4		-	-	-	-	-	-	-	22
IV	VIII	6.0	6	4	2	2	-	-	0	-	-	8		-	-	-	-	-	-	-	22
Four Year UG Degree (Honours with Research) with Major and Minor with 176 credits																				

B. Sc. Programme Framework: Course Distribution

Year	Semester	Level	Major											Minor		OE	CC	AEC	VEC	Total
			DSC		DSE		SEC		VSC		FP/OJT/IN/CEP		IKS							
I	-	-	T	P	T	P	T	P	T	P	T	P		T	P	-	-	-	-	-
I	I	4.5	**2**	**1**	-	-	-	1	-	-	-	-	1	1		1	1	1	1	10
	II	4.5	**2**	-	-	-		1	-	**1**	-	-		1		1	1	1	1	09
Exit Option: Award of UG Certificate in Major with 44 credits and an additional 4 credit core NSQF course /Internship or Continue with major and minor																				
II	III	5.0	**2**	**1**	-	-		**1**	-	-	-	**1**		1		1	1	1	-	09
II	IV	5.0	**2**	**1**	-	-		-	-	**1**	-	**1**		1		1	1	1	-	09
Exit Option: Award of UG Diploma in Major with 88 credits and an \additional 4 credit core NSQF course /Internship or Continue with major and minor																				
III	V	5.5	**2**	**1**	**1**	**1**	-	-	-	**1**		**1**		1		-	-	-	-	08
III	VI	5.5	**2**	**1**	**1**	**1**	-	-	-	**1**		**1**		1		-	-	-	-	08

Exit Option: Award of UG Degree in Major and Minor with 132 credits or continue with Major for a 4-year Degree																					
IV	VII	6.0	**3**	**3**	**1**	**1**	**0**	**1**	-	-	-	-		-	-	-		-	-	-	09
IV	VIII	6.0	3	**3**	**1**	**1**	-	-	-	-	-	**1**		-	-	-	-	-	-	-	09
Four Year UG Degree(Honours) with Major and Minor with 176 credits																					
IV	VII	6.0	**2**	**2**	**1**	**1**	**0**	**1**	-	-	-	**1**		-	-	-	-	-	-	-	08
IV	VIII	6.0	**2**	**2**	**1**	**1**	-	-	-	-	-	**1**		-	-	-	-	-	-	-	07
Four Year UG Degree (Honours with Research) with Major and Minor with 176 credits																					

Programme Framework (Course Distribution): B.Sc. Mathematics (Major)

Year	Semester	Level	Major											Total	
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP/PR		IKS		
			T	P	T	P	T	P	T	P	T	P	T	T	P/PR
I	I	4.5	2	1	-	-	-	1	-	-	-	-	01	03	02
I	II	4.5	2	-	-	-		1	-	1	-	-		02	02
II	III	5.0	2	1	-	-		1	-	-	-	1		02	03
II	IV	5.0	2	1	-	-		-	-	1	-	1		02	03
III	V	5.5	2	1	1	1	-	-	-	1		1		03	04
III	VI	5.5	2	1	1	1	-	-	-	1		1		03	04
B.Sc. Honours															
IV	VII	6.0	3	3	1	1	RM-1		-	-	-	-		05	04
IV	VIII	6.0	3	3	1	1	-	-	-	-	-	1		04	05
B.Sc. Honours with Research															
IV	VII	6.0	2	2	1	1	RM-1		-	-	-	1		04	04
IV	VIII	6.0	2	2	1	1	-	-	-	-	-	1		03	04

Programme Framework (Credit Distribution): B.Sc. Mathematics (Major)

Year	Semester	Level	Major											Total
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP/RP		IKS	
			T	P	T	P	T	P	T	P	T	P	**T**	
I	I	4.5	4	2	-	-	-	2	-	-	-	-	02	10
I	II	4.5	6	-	-	-		2	-	2	-	-		10
II	III	5.0	6	2	-	-		2	-	-	-	2		12
II	IV	5.0	6	2	-	-		-	-	2	-	2		12
III	V	5.5	8	2	2	2	-	-	-	2		2		18
III	VI	5.5	6	2	2	2	-	-	-	2		4		18
IV	VII	6.0	8	6	2	2	RM -4		-	-	-	-		22
IV	VIII	6.0	8	6	2	2	-	-	-	-	-	4		22
IV	VII	6.0	6	4	2	2	RM -4	-	-	-	-	4		22
IV	VIII	6.0	6	4	2	2	-	-	-	-	-	8		22

Programme Framework (Courses and Credits): B.Sc. Mathematics (Major)

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	DSC-1	BS-MT111T	Set and Matrix Theory	02
2.	I	I	4.5	DSC-2	BS-MT112T	Calculus-I	02
3.	I	I	4.5	DSC-3	BS-MT113P	Practical Based on Set and Matrix Theory	02
4.	I	I	4.5	SEC-1	BS-MT114P	Practical Based on Calculus-I	02
5.	I	I	4.5	IKS-1	BS-MT115T	Ancient Mathematicians	02
6.	I	II	4.5	DSC-4	BS-MT121T	Analytical Geometry	**03**
7.	I	II	4.5	DSC-5	BS-MT122T	Calculus-II	**03**
8.	I	II	4.5	SEC-2	BS-MT123P	Practical Based on Analytical Geometry	02
9.	I	II	4.5	VSC-1	BS-MT124P	Practical Based on Calculus-II	02
10.	II	III	5.0	DSC-6	BS-MT231T	Calculus of Several Variable	03
11.	II	III	5.0	DSC-7	BS-MT232T	Numerical Methods	03

12.	II	III	5.0	DSC-8	BS-MT233P	Practical Based on Calculus of Several Variable	02
13.	II	III	5.0	SEC-3	BS-MT234P	Practical Based on Numerical Methods	02
14.	II	III	5.0	FP-01	BS-MT235P	Python Programming I	02
15.	II	IV	5.0	DSC-9	BS-MT242T	Computational Linear Algebra	03
16.	II	IV	5.0	DSC-10	BS-MT242T	Mathematical Transforms	03
17.	II	IV	5.0	DSC-11	BS-MT243P	Practical Based on Computational Linear Algebra	02
18.	II	IV	5.0	VSC-2	BS-MT244P	Practical Based on Mathematical Transforms	02
19.	II	IV	5.0	CEP-01	BS-MT245P	Python Programming II	02
20.	III	V	5.5	DSC-12	BS-MT351T	Foundation of Real Analysis	04
21.	III	V	5.5	DSC-13	BS-MT352T	Metric Space	04
22.	III	V	5.5	DSC-14	BS-MT353P	Differential Geometry	02
23.	III	V	5.5	DSE-01	BS-MT355T	Group Theory	02
24.	III	V	5.5	DSE-02	BS-MT356P	Operations Research	**02**
25.	III	V	5.5	VSC-3	BS-MT357P	LaTeX –I (Scientific Writing)	02
26.	III	V	5.5	FP-02	BS-MT358P	Machine Learning- I	02
27.	III	VI	5.5	DSC-15	BS-MT361T	Complex Analysis	03
28.	III	VI	5.5	DSC-16	BS-MT362T	Graph Theory	03
29.	III	VI	5.5	DSC-17	BS-MT363P	Lattice Theory	**02**
30.	III	VI	5.5	DSE-03	BS-MT364T	Ring Theory	02
31.	III	VI	5.5	DSE-04	BS-MT365P	Optimization Techniques	02
32.	III	VI	5.5	VSC-4	BS-MT366P	LaTeX –II (Scientific Writing)	02
33.	III	VI	5.5	OJT-01	BS-MT367P	Machine Learning- II	04

34.	IV	VII	6.0	DSC-18	BS-MT471T	Linear Algebra	03
35.	IV	VII	6.0	DSC-19	BS-MT472T	Real Analysis	03
36.	IV	VII	6.0	DSC-20	BS-MT473T	Group Theory	02
37.	IV	VII	6.0	DSC-21	BS-MT474P	Multivariable Calculus	02
38.	IV	VII	6.0	DSC-22	BS-MT475P	Advanced Calculus	02
39.	IV	VII	6.0	DSC-23	BS-MT476P	Lab for Numerical Linear Algebra	02
40.	IV	VII	6.0	DSE-05	BS-MT477T	Ordinary Differential Equations	02
41.	IV	VII	6.0	DSE-06	BS-MT478P	Advanced LaTeX	02
42.	IV	VII	6.0	RM-01	BS-MT479T/P	Research Methodology and Computer Applications	04
43.	IV	VIII	6.0	DSC-24	BS-MT481T	Topology	03
44.	IV	VIII	6.0	DSC-25	BS-MT482T	Advanced Complex Analysis	03
45.	IV	VIII	6.0	DSC-26	BS-MT483T	Ring Theory	02
46.	IV	VIII	6.0	DSC-27	BS-MT484P	Advanced Numerical Analysis	02
47.	IV	VIII	6.0	DSC-28	BS-MT485P	Advanced Operations Research	02
48.	IV	VIII	6.0	DSC-29	BS-MT486P	Mathematical Statistics	02
49.	IV	VIII	6.0	DSE-07	BS-MT487T	Partial Differential Equations	02
50.	IV	VIII	6.0	DSE-08	BS-MT488P	Combinatorics	02
51.	IV	VIII	6.0	OJT-02	BS-MT489P	Programming Language: C	04

34.	IV	VII	6.0	DSC-20	BS-MT471T	Linear Algebra	03
35.	IV	VII	6.0	DSC-21	BS-MT472T	Real Analysis	03
36.	IV	VII	6.0	DSC-22	BS-MT473P	Ordinary Differential Equations	02
37.	IV	VII	6.0	DSC-23	BS-MT474P	Multivariable Calculus	02
38.	IV	VII	6.0	DSE-05	BS-MT475T	Advanced Calculus	02
39.	IV	VII	6.0	DSE-06	BS-MT476P	Probability and Statistical Methods	02
40.	IV	VII	6.0	RM-01	BS-MT477T/P	Research Methodology and Computer Applications	04
41.	IV	VII	6.0	RP-01	BS-MT488P	Research Project	04
42.	IV	VIII	6.0	DSC-20	BS-MT481T	Topology	03
43.	IV	VIII	6.0	DSC-21	BS-MT482T	Advanced Complex Analysis	03
44.	IV	VIII	6.0	DSC-22	BS-MT483T	Ring Theory	02
45.	IV	VIII	6.0	DSC-23	BS-MT484P	Advanced Numerical Analysis	02
46.	IV	VIII	6.0	DSE-07	BS-MT485P	Advanced Operations Research	02
47.	IV	VIII	6.0	DSE-08	BS-MT486P	Partial Differential Equations	02
48.	IV	VIII	6.0	RP-02	BS-MT487P	Research Project	08

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Board of Studies in Mathematics

Sr. No.	Name	Designation
1.	Dr. S. B. Gaikwad	Chairman
2.	Dr. S. V. Ingale	Member
3.	Mr. S. A. Tarate	Member
4.	Mr. K. A. Kshirsagar	Member
5.	Ms. B. N. Todkari	Member
6.	Ms. D. G. Gade	Member
7.	Mr. A. S. Jadhav	Member
8.	Ms. P. D. Kasule	Member
9.	Ms. P. S. Ansari	Member
10.	Mr. R. V. Sharma	Member
11.	Mr. T. A. Bhakare	Member
12.	Mr. H. N. Shaikh	Member
13.	Dr. A. A. Kulkarni	Member
14.	Prof. (Dr). A. V. Mancharkar	Member
15.	Dr. N. S. Darkunde	Academic Council Nominee
16.	Dr. S. B. Bhalekar	Academic Council Nominee
17.	Dr. G. S. Kadu	Vice-Chancellor Nominee
18.	Mr. P. L. Pawar	Alumni
19.	Mr. Shirish Padalkar	Industry Expert

1. Prologue/ Introduction of the programme:

Welcome to the B.Sc. Mathematics Honours and Honours by Research program! This program is designed for students who have a passion for mathematics and wish to pursue an in-depth study of this fascinating field. Through this prologue, let's explore the essence and significance of this program. The B.Sc. Mathematics Honours program offers a comprehensive curriculum that combines core mathematical principles with advanced topics, enabling students to develop a strong foundation in mathematics. This program is specifically tailored for students who are seeking a rigorous academic experience and aspire to pursue higher studies or research in mathematics. The Honours by Research component provides students with an opportunity to delve deeper into a specific area of mathematics under the guidance of experienced faculty members. This research-oriented approach allows students to explore their interests, develop critical thinking skills, and make original contributions to the field of mathematics. It serves as a stepping stone for those considering a career in academia or research.

During the course of the program, students will be exposed to a wide range of mathematical topics, including calculus, algebra, geometry, number theory, mathematical analysis, probability theory, and more. They will acquire both theoretical knowledge and practical problem-solving skills, enabling them to tackle complex mathematical problems and develop analytical thinking abilities. The program emphasizes the development of mathematical reasoning, logical thinking, and the ability to communicate mathematical ideas effectively. Students will engage in rigorous mathematical proofs, problem-solving exercises, and mathematical modeling, fostering their ability to analyze and interpret real-world phenomena using mathematical principles. Through hands-on projects, seminars, and collaborative research opportunities, students will also develop essential skills such as data analysis, computer programming, and numerical methods, which are increasingly important in today's data-driven world. The B.Sc. Mathematics Honours and Honours by Research program aims to cultivate a deep appreciation for the elegance and beauty of mathematics while nurturing the intellectual curiosity and creativity of students. It provides a supportive learning environment where students can interact with faculty members, participate in academic discussions, and engage in a vibrant mathematical community. Upon successful completion of the program, students will be equipped with a solid foundation in mathematics, critical thinking skills, and research experience. Graduates will have a wide range of career options, including pursuing advanced degrees in mathematics or related disciplines, teaching mathematics at the secondary or tertiary level, working in research institutions, or applying their mathematical skills in industries such as finance, technology, data science, and more. We invite you to embark on this exciting journey of discovery and exploration in the field of mathematics. Through the B.Sc. Mathematics Honours and Honours by Research program, you will develop a profound understanding of mathematics, acquire invaluable skills, and contribute to the advancement of

this timeless discipline. Get ready to unlock the wonders of mathematics and make your mark in the world of numbers!

2. Programme Outcomes (POs)

1. Graduates will have a solid foundation in fundamental mathematical concepts, theories, and techniques across various branches of mathematics, including calculus, algebra, geometry, analysis, and discrete mathematics.

2. Students will acquire advanced knowledge in specialized areas of mathematics through coursework, seminars, and research projects.

3. Graduates will develop strong analytical and critical thinking skills, enabling them to analyze complex mathematical problems, identify patterns, and develop logical and rigorous proofs. They will be adept at applying mathematical principles to solve real-world problems.

4. Students will develop exceptional problem-solving skills, both in theoretical and practical contexts. They will be able to formulate and solve mathematical problems using appropriate mathematical techniques and tools.

5. The Honours by Research component of the program will equip students with the necessary skills to conduct independent mathematical research. Graduates will be proficient in formulating research questions, designing experiments or investigations, collecting and analyzing data, and presenting their findings in a coherent and rigorous manner.

6. Students will be capable of formulating mathematical models, interpreting their results, and making informed predictions or decisions based on the models.

7. Students will be able to explain mathematical concepts clearly, write technical reports and research papers, and engage in scholarly discussions.

8. Students will develop proficiency in using mathematical software, programming languages, and computational tools for data analysis, numerical simulations, and mathematical modeling.

9. Students will develop an understanding of the ethical responsibilities and professional standards associated with mathematical research and practice. They will exhibit integrity, intellectual honesty, and respect for intellectual property rights in their work.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Mathematics (Major)

Title of the Course: Set and Matrix Theory								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-1	BS-MT111T	02	00	02	30	15	35	50

Learning Objectives:

1. Describe memberships of sets, including the empty set, using proper notation, and decide whether given items are members and determine the cardinality of a given set.
2. Describe the relations between sets regarding membership, equality, subset, and proper subset, using proper notation.
3. Perform the operations of union, intersection, complement, and difference on sets using proper notation.
4. Be able to draw and interpret Venn diagrams of set relations and operations and use Venn diagrams to solve problems.
5. Recognize when set theory is applicable to real-life situations, solve real-life problems, and communicate real-life problems and solutions to others.

Course Outcomes (Cos):

1. Construct proofs of basic set-theoretic identities involving unions, intersections, and Cartesian products.
2. Formulate the negation, converse, and contrapositive of a quantified implication, both linguistically and in symbolic form.
3. Demonstrate an understanding of the concept of a "counterexample" and be able to provide appropriate instances.
4. Demonstrate an understanding of the Principle of Mathematical Induction.
5. Understand the concepts of propositions, truth tables, predicates and quantifiers, relation, partition etc.

Detailed Syllabus:

Unit 1: Sets, Relation and Functions. (06 Hours)

1.1 Sets, Set Operations.

1.2 Relations, Equivalence relations, equivalence classes and partitions of sets.

1.3 Functions, Basic terminology, types of functions.

1.4 Inverse of function, Composition of function.

Unit 2: Mathematical Logic (07 Hours)

2.1 Introduction.
2.2 Statements.
2.3 Propositions and Truth Table.
2.4 Propositional equivalence.
2.5 Quantifiers.

Unit 3: Induction and Recursion (07 Hours)

3.1 Introduction.
3.2 Mathematical Induction.
3.3 Strong Induction and Well-Ordering.
3.4 Recursive Definitions and Structural Induction.

Unit 4: Matrices and System of Equations (10 Hours)

4.1 Matrices and their types.
4.2 Multiplication of Matrices.
4.3 Invertible Matrices.
4.4 Homogeneous Linear Equations and Elimination.
4.5 Row Operations and Elementary Matrices.
4.6 Solve the linear system by Gauss Elimination.

Suggested Readings:

1. Set Theory and Logic, Robert R. Stoll, Errasia publishers, New Delhi.
2. Discrete Mathematics and its Applications, K.H. Rosen, Tata McGraw, New.
3. Kenneth H. Rosen. Discrete Mathematics and its Applications. (7th edition) McGraw-Hill Higher Education, 2017 Delhi.
4. Introduction to Linear Algebra, SERGE LANG, Springer Verlag.
5. Linear Algebra, 4th Edition (2009) Lipschutz-Lipson.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Mathematics (Major)

Title of the Course: Calculus-I								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-2	BS-MT112T	02	00	02	30	15	35	50

Learning Objectives:

1. Give the students a sufficient knowledge of fundamental principles.
2. Introduce methods and a clear perception of inumerous power of mathematical ideas.
3. Introduce the concept of limit and continuity.
4. Calculate definite integrals that may involve logarithms, exponentials, polynomials and powers by using the fundamental theorem of calculus.

Course Outcomes (Cos):

1. Understand the concept of limits.
2. Examine the continuity of real-valued functions.
3. Get familier with the techniques of differentiation of functions with real values.
4. Use basic techniques of integration to find antiderivatives.

Detailed Syllabus:

Unit I: Limits (06 Hours)

1.1 Limit of a function, Cluster point, ε - δ definition of limit.
1.2 Sequential criterion for limits, Divergence criteria.
1.3 Algebra of limits, Squeeze theorem, Examples.
1.4 Right hand limits and Left hand limits, Examples.

Unit II: Continuity (06 Hours)

2.1 Continuous functions, Sequential criterion, Discontinuity criterion.
2.2 Combinations of continuous functions.
2.3 Continuous functions on intervals.
2.4 Uniform continuity, Lipschitz functions.

Unit III: Differentiation (08 Hours)

3.1 Introduction.
3.2 Some basic derivatives: constant function, x^n
3.3 Rules of differentiation, Chain rule.
3.4 Derivative of Exponential function, Trigonometric functions, Inverse trigonometric functions, Logarithmic functions, Hyperbolic functions.

Unit IV: Integration (10 Hours)

4.1 Integral of function and basic integrals.
4.2 Integration by substitution and integration by parts.
4.3 Definite integrals.
4.4 Integration of algebraic rational functions.

Suggested Readings:

1. Introduction to Real Analysis by R. G. Bartle and D. R. Sherbert, John Wiley and Sons Inc, Fourth edition.
2. Differential Calculus by Shanti Narayan and P. K. Mittal, S. Chand and company ltd., Revised edition 2005.
3. Integral Calculus by Shanti Narayan and P. K. Mittal, S. Chand and company ltd.
4. Elementary analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Mathematics (Major)

Title of the Course: Practical Based on Set Theory and Logic								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-3	BS-MT113P	00	02	02	60	15	35	50

Learning Objectives:

1. Learn Free and Open Source Software (FOSS) tools for computer programming.
2. Solve problem on algebra and calculus by using FOSS software's.
3. Acquire knowledge of applications of algebra and calculus through FOSS.
4. Knowledge of application of mathematics

Course Outcomes (Cos):

1. Learn Mathematical software.
2. Problem solve on set theory and logic by using maxima software.
3. Knowledge of application of mathematics.
4. Develop the short programs using Maxima software.

Detailed Syllabus:

Practical/Lab work to be performed in Computer Lab.

List of the practicals to be done using R/ Python/ Maxima/ Mathematica/ MATLAB/ Maple/ Scilab etc.

1. Introduction to software.
2. Computation of Basic Arithmetic Operators.
3. Function, composition, Inverse function.
4. Introduction to logical Operators.
5. Computation of Recurrence Relation.
6. Matrices and its Properties.
7. Computation of Algebra of Matrices.
8. Computation of operations on Matrices.
9. Computation of Inverse of a Matrix.
10. Computation of Echelon forms.

Suggested Readings:

1. Think Python, book by Allen B. Downey, published by O'Reilly Media, second edition.

2. Essential MATLAB for Scientists and Engineers, book by Brian D. Hahn, 8th edition.

3. Maple: A Primer, book by Bernard V Liengme, 2019.

4. The Mathematica Book, by Stephen Wolfram, Fifth Edition, published by Wolfram Media.

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Mathematics (Major)

Title of the Course: Practical based on Calculus-I								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
SEC-1	BS-MT114P	00	02	02	60	15	35	50

Learning Objectives:

1. Apply information technology principles and practices to real-world solutions.
2. Compute limits, derivatives and integrals.
3. Analyze functions using limits.
4. Analyze functions using derivatives and integrals.

Course Outcomes (Cos):

1. Learn Free and Open Source Software(FOSS).
2. Solve problems on calculus using FOSS.
3. Acquire knowledge of applications of calculus through FOSS.
4. Apply these concepts for advance study in mathematics.

Detailed Syllabus:

Practical/Lab work to be performed in Computer Lab.

List of the practicals to be done using R/ Python/ Maxima/ Mathematica/ MATLAB/ Maple/ Scilab etc.

1. Introduction to the software with basic examples.
2. Evaluation of limit of simple functions.
3. Evaluation of Right Hand Limits and Left Hand Limits.
4. Plotting of 2D graphs of different functions.
5. Determination of limit of functions using graphs.
6. Determination of continuity of functions using graphs.
7. Finding the derivative of functions using definition of limit.
8. Finding derivatives of trigonometric functions, inverse trigonometric functions, logarithmic functions, hyperbolic functions.
9. Evaluation of Indefinite integrals.
10. Evaluation of Definite integrals.

Suggested Readings:

1. Think Python, book by Allen B. Downey, published by O'Reilly Media, second edition.

2. Essential MATLAB for Scientists and Engineers, book by Brian D. Hahn, 8th edition.

3. Maple: A Primer, book by Bernard V Liengme, 2019.

4. The Mathematica Book, by Stephen Wolfram, Fifth Edition, published by Wolfram Media, Inc., 2003.

5. wxMaxima for Calculus-I, Zachary Hannan, Solano Community College.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

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Syllabus

B.Sc. Mathematics (Major)

Title of the Course: Ancient Mathematicians								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
IKS-1	BS-MT115P	00	02	02	30	15	35	50

Learning Objectives:

1. Students can learn techniques such as sutras (aphorisms) and sub-sutras, which enable them to perform complex calculations mentally and more rapidly.
2. Students can enhance their ability to perform arithmetic calculations mentally and develop a stronger number sense.
3. Vedic Mathematics promotes visualization and pattern recognition, enabling students to identify relationships and patterns within numbers and mathematical operations.
4. Vedic Mathematics also introduces students to advanced mathematical concepts, such as algebraic manipulations, trigonometry, calculus, and number theory.

Course Outcomes (Cos)

1. Understand the Vedic methods of arithmetic.
2. Understand the Vedic methods of division with two/three digit divisor.
3. Understand the Vedic methods of power and root power of two-digit numbers.
4. Understand the techniques for different types of calculations, including multiplication, division, square roots, cube roots, and more.

Detailed Syllabus:

Unit I: Introduction of Vedic Mathematics (05 Hours)

1.1 History of Vedic Mathematics.
1.2 Salient features of Vedic Mathematics.
1.3 Formulae – 16 sutras, 13 sub sutras – terms and operations.
1.4 High speed addition by using the concept of computing the whole and from left to right – super fast subtraction by Nikhilam sutras from basis 100,1000,10,000.

Unit II: Product and Division (10 Hours)

2.1 Multiplication by Urdhavtrighbhyam sutram.
2.2 Multiplication by vinculum sutram.
2.3 Multiplication by Nikhilam sutram, Fast multiplication by 11.
2.4 Multiplication of numbers consisting of all 9's.
2.5 Multiplication of numbers nearest to the base 10 and multiplication of sub base 50,500,5000.
2.6 Decimals and fractions – division by Nikhilam sutram.
2.7 Division of 1/19, 1/29 by ekadhikenpurven sutram.
2.8 Division by paravartya sutram, division by anurupeyana sutram.

2.9 Division of polynomials - factors of general second-degree equation by lopsthapanabhayam sutram.

Unit III: Indian Mathematicians and their contribution (10 Hours)

3.1 Contribution of Indian Mathematicians in light of Arithmetic and Algebra.
3.2 Aryabhatta.
3.3 Brahmagupta.
3.4 Mahaveeracharya.
3.5 Bhaskaracharya.
3.6 Varahmihir.

Unit IV: Mathematicians and their contribution (05 Hours)

4.1 Archimedes
4.2 Pythagoras
4.3 Euclid
4.4 Diophantus
4.5 Plato

Suggested Readings :

1. Vedic Mathematics, Jagadguru Sankaracarya Swami Sri Bharati Krsna Tirthaji Maharaja, Motilal Banarsidass Publishers, New Delhi.
2. Vedic Ganita: Vihangama Drishti-1,Shiksha Sanskriti Utthan Nyas, New Delhi.
3. Bharatiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi.
4. Leelavati, Chokhambha Vidya Bhavan, Varanasi.

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Syllabus
B.Sc. Mathematics (Major)

Title of the Course: Analytical Geometry								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-4	BS-MT121T	03	00	03	45	30	70	100

Learning Objectives:
1. To study Conic Sections in a general form and their reduction to standard form.
2. To study planes, lines, and sphere in three-dimensional space.
3. To express equations of the plane in space.
4. To express the equation of cone and cylinder.

Course Outcomes (Cos)

1. Introduction to analytical geometry of two-dimensional.
2. Study of lines in two and three dimensions.
3. Finding equations in various forms of line, circle, ellipse, sphere, cones etc.
4. Sketch the graphs of some special curves by using polar coordinates on the plane.
5. Study of rotations and translations of axes.

Detailed Syllabus:

Unit I: Analytical Geometry of two Dimensions and Planes (19 Hours)

1.1 Change of axes: Translation and Rotation.
1.2 Conic Sections: General equation of second degree in two variables.
1.3 Reduction to standard form, Centre of Conic, nature of Conic.
1.4 Direction Cosines and direction ratio's, Equation of Plane, Normal form, Transform to the normal form, Plane passing through three non – collinear points, Intercept form, Angle between two planes.

Unit II: Lines in three Dimensions (08 Hours)

2.1 Equations of a line in Symmetric and Unsymmetric forms, Line passing through two points, Angle between a line and a plane.
2.2 Perpendicular distance of a point from a plane, condition for two lines to be coplanar (without proof).
2.3 Skew lines, shortest distance between skew lines and equation of line of shortest distance between two skew lines.

Unit III: Sphere (09 Hours)

3.1 Equation of a sphere in different forms, plane section of a sphere.

3.2 Equation of a circle, Sphere through a given circle.
3.3 Intersection of a sphere and a line, Equation of tangent plane to sphere.

Unit IV: Cones and Cylinders (09 Hours)

4.1 Definition of cone and cylinder.
4.2 Equation of cone and cylinder with vertex at origin and (α,β,γ).
4.3 The right circular cone, equation of right circular cone.
4.4 The right circular cylinder, equation of a right circular cylinder.

Suggested Readings:

1. Analytic Geometry in two and three Dimensions: Von Steuben
2. Analytical Solid Geometry: Shantinarayan, S chand and Company Ltd, New Delhi ,1998
3. P.K.Jain and Khalil Ahmad : A text book of Analytical Geometry of three dimensions, Wiley Estern Ltd .1999.
4.Analytical Geometry of Two and Three Dimensions: Qazi Zameeruddin; Narosa Publ.

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New Arts, Commerce, and Science College, Ahmednagar
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Syllabus
B.Sc. Mathematics (Major)

Title of the Course: Calculus-II								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-5	BS-MT122T	03	00	03	45	30	70	100

Learning Objectives:

1. To understand different indeterminate forms.
2. Learn to work with logarithmic, exponential and inverse trigonometric functions.
3. Find sequence of partial sums of an infinite series.
4. Calculate higher order derivatives.

Course Outcomes (Cos):

1. Learn successive differentiation.
2. Understand the consequences of various mean value theorems for differentiable functions.
3. Assimilate the notions of limit of sequence and convergence of series of real numbers.
4. Learn some of the properties of Riemann integrable functions and the application of the fundamental theorem of integrations.
5. Apply these concepts for advanced study in mathematics.

Detailed Syllabus:

Unit I: Successive Differentiation (14 Hours)

1.1 Introduction.
1.2 L' Hospitals rule, Indeterminate forms.
1.3 Higher order derivatives.
1.4 Calculation of nth derivative, n^{th} derivative of rational functions.

Unit II: Expansion of Functions and Mean Value Theorems (10 Hours)

2.1 Rolle's theorem.
2.2 Lagrange's mean value theorem.
2.3 Cauchy's mean value theorem.
2.4 Taylor's theorem.
2.5 Maclaurin's theorem.

Unit III: Sequences and Series (12 Hours)

3.1 The algebraic and order properties of R.
3.2 Triangle inequality.
3.3 Supremum and Infimum, Archimedean property, The Density theorem.
3.4 Sequences, Bounded Sequences.
3.5 Introduction to Infinite series.

Unit IV: Riemann Integration (09 Hours)

4.1 Definition Partition.
4.2 Upper Sum, Lower Sum.
4.3 Definition of Riemann Integral.
4.4 Properties of Riemann Integral.
4.5 Fundamental Theorem of Calculus.

Suggested Readings:

1. Differential Calculus by Shanti Narayan and P. K. Mittal, S. Chand and company ltd., Revised edition 2005.
2. Introduction to Real Analysis by R. G. Bartle and D. R. Sherbert, John Wiley and Sons Inc, Fourth edition.
3. Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.
4. Introduction to Real Analysis, William F. Trench, Free edition, 2010.

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Syllabus
B.Sc. Mathematics (Major)

Title of the Course: Practical Based on Analytical Geometry								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
SEC-2	BS-MT123P	00	02	02	60	15	35	50

Learning Objectives:

1. Translation and rotation of axes.
2. Learn basic concepts of the sphere.
3. Learn to determine the point of intersection of lines.
4. Learn to draw cones and cylinder.

Course Outcomes (Cos):

1. Learn Free and Open Source Software (FOSS) tools for computer programming.
2. Gain appropriate skills to solve problems using software.
3. Acquire knowledge of applications of analytical geometry through FOSS.
4. Apply these concepts for advance study in mathematics.

Detailed Syllabus:

Practical/Lab Work to be performed in computer lab

List of Practical's to be done using R / Python / Maxima / Mathematica / MATLAB / Maple / Scilab etc.

Practical 1: Introduction to Software with basic examples.

Practical 2: Translation and rotation of axes.

Practical 3: Centre and nature of conic.

Practical 4: Draw the graph of Plane and finding equation of plane – 1.

Practical 5: Draw the graph of Plane and finding equation of plane – 2.

Practical 6: Line.

Practical 7: Coplanar lines.

Practical 8: Sphere-1.

Practical 9: Cones and Cylinders.

Practical 10: Solve various exercises using software.

Suggested Readings:

1. Think Python, book by Allen B. Downey, published by O'Reilly Media, second edition.

2. Essential MATLAB for Scientists and Engineers, book by Brian D. Hahn, 8th edition.

3. Maple: A Primer, book by Bernard V Liengme, 2019.

4. The Mathematica Book, by Stephen Wolfram, Fifth Edition, published by Wolfram Media, Inc., 2003.

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New Arts, Commerce and Science College, Ahmednagar
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Syllabus
B.Sc. Mathematics (Major)

Title of the Course: Practical based on Calculus-II								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
VSC-1	BS-MT124P	00	02	02	60	15	35	50

Learning Objectives:

1. Apply information technology principles and practices to real-world solutions.
2. Compute limits and n^{th} order derivatives.
3. Learn series expansions and mean value theorems.
4. Evaluate Riemann sum.

Course Outcomes (Cos):

1. Learn Free and Open Source Software(FOSS).
2. Solve problems on calculus using FOSS.
3. Acquire knowledge of applications of calculus through FOSS.
4. Apply these concepts for advance study in mathematics.

Detailed Syllabus:

Practical/Lab work to be performed in Computer Lab.

List of the practicals to be done using R/ Python/ Maxima/ Mathematica/ MATLAB/ Maple/ Scilab etc.

1. Introduction to the software with basic examples.
2. Indeterminate forms and evaluation of limits using L'Hospital rule.
3. Finding the nth derivative of e^{ax}, trigonometric, hyperbolic.
4. Finding the nth derivative of logarithmic and algebraic functions.
5. Finding the nth derivative of $e^{ax+b}\sin(bx+c)$, $e^{ax+b}\cos(bx+c)$.
6. Finding Taylor's and Maclaurin's expansions of the given functions.
7. Verification of Mean Value Theorems.
8. Plotting of 3D graphs of different functions.
9. Generation of sequences.
10. Evaluation of Riemann sum.

Suggested Readings:

1. Think Python, book by Allen B. Downey, published by O'Reilly Media, second edition.
2. Essential MATLAB for Scientists and Engineers, book by Brian D. Hahn, 8th edition.
3. Maple: A Primer, book by Bernard V Liengme, 2019.
4. The Mathematica Book, by Stephen Wolfram, Fifth Edition, published by Wolfram Media, Inc., 2003.
5. wxMaxima for Calculus, Zachary Hannan, Solano Community College.