Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

Choice Based Credit System (CBCS)

Bachelor of Science (B. Sc.)

Syllabus of

F. Y. B. Sc. Mathematics

Implemented from

Academic year 2021 -22

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

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

Board of studies in Mathematics

Sr. No.	Name	Affiliation	Designation
1.	Dr. S. B. Gaikwad	Associate Professor, N.A.C.& Sc. College, Ahmednagar	Chairman
2.	Dr. S. V. Ingale	Assistant Professor, N.A.C.& Sc. College, Ahmednagar	Member
3.	Mr. S. A. Tarate	Assistant Professor N.A.C.& Sc. College, Ahmednagar	Member
4.	Dr. N. S. Darkunde	Assistant Professor School of Mathematical Sciences, Swami Ramanand Teerth Marathwada University, Nanded-43160 Hrs6	Member, Nominated by Academic council
5.	Dr. S. B. Bhalekar	Associate Professor, School of Mathematics and Statistics, University of Hyderabad, Central University Campus, Hyderabad- 500046	Member, Nominated by Academic council
6.	Dr. G. S. Kadu	Assistant Professor, Department of Mathematics, Savitribai Phule Pune University, Pune	Member, Nominated by Hon. Vice Chancellor, SPPU, Pune
7.	Mr. P. L. Pawar	Junior College Teacher, Ahmednagar College, Ahmednagar	Member, Alumina Nominated by Hon. Principal
8.	Mr. Shirish Padalkar	Principal Engineer, Medly Software System, LLP, Pune	Member, Industry/ Corporate Nominatedby Hon. Principal
9.	Dr. A. A. Kulkarni	Assistant Professor, Department of Statistics N.A.C.& Sc. College, Ahmednagar	Member (Coopted)
10.	Dr. A. V. Mancharkar	Professor and HOD Department of Physics N.A.C.& Sc. College, Ahmednagar	Member (Coopted)

1. Prologue/ Introduction of the programme:

This program includes mathematical branches Algebra, Calculus, Analytical geometry. Concepts of sets, Integers, relations, matrices, and complex numbers are included in algebra. Algebra teaches to follow a logical path to solve a problem. This, in turn, allows us to better understand how numbers function and work together in an equation. Calculus course consists of limits, continuity, sequences, and series. Calculus is mainly the study of how things change. It provides a framework for modeling systems in which there is change and a way to deduce the predictions of such models.

Analytic geometry includes two-dimensional geometry, planes, and lines in three dimensions. Analytical geometry is used in physics and engineering and aviation, rocketry, space science, and spaceflight. It is the foundation of most modern fields of geometry, including algebraic, differential, discrete, and computational geometry.

Rules and Regulation:

The B.Sc. program is of 3 academic years and 6 semesters. The minimum total number of credits requirements for each program is 132 credits and 08 additional credits.

1. Each theory credit is equivalent to 15 clock Lectures of teaching and each practical is equivalent to 30 Lectures of laboratory teaching in each semester.
2. The duration of each theory semester is 15-18 weeks in which at least 12-week classroom teaching and 03 weeks of continuous internal assessment is must.
3. The duration of each practical semester is 15 to 18 weeks in which at least 14-week laboratory session and one week of internal evaluation including viva and journal certification is must.

2. Programme outcomes (Pos)

Students enrolled in the program complete a curriculum that exposes and trains students in a full range of essential skills and abilities. They will have the opportunity to master the following objectives.

I. To provide students with rigorous and thorough knowledge of a broad range of pure and applied areas of mathematics.

II. To impart knowledge from basic and advanced level concepts with applications in various fields of mathematics.

III. To develop ability to use efficiently Mathematical software.

IV. To get theoretical inputs and substantial hands-on experience in knowledge-making.

V. To get in-depth knowledge in applied mathematics and motivate them for various research activities.

I. Programme Structure and Course Titles

Sr. No.	Class	Semester	Course Code	Course Title	Credits
1.	F.Y. B.Sc.	I	**BSC-MT 101 T**	Algebra	2
2.	F.Y. B.Sc.	I	**BSC-MT 102 T**	Calculus - I	2
3.	F.Y. B.Sc.	I	**BSC-MT 103 P**	Mathematics Practical	1.5
4.	F.Y. B.Sc.	II	**BSC-MT 201 T**	Analytical Geometry	2
5.	F.Y. B.Sc.	II	**BSC-MT 202 T**	Calculus - II	2
6.	F.Y. B.Sc.	II	**BSC-MT 203 P**	Mathematics Practical	1.5

Semester -I	**Paper -I**
Course Code: BSC-MT 101 T	**Title of the Course:** Algebra
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (Cos):

1. Learn and understand the sets, relations and basic terminology of functions.
2. Understand the divisibility fundamental theorem of arithmetic and Fermat's theorem.
3. Recognize consistence and in-consistence systems of linear equations by the row-echelon form of the augmented matrix.
4. Understand the nth root of unity.

Details of Syllabus:

Unit 1: Sets, Relation & Functions [7 Lectures]

1.1 Sets, Relations, Equivalence relations, equivalence classes & partitions of set

1.2 Functions, Basic terminology, types of functions, Inverse of function, Composition of function (only examples)

Unit 2: Integers [10 Lectures]

2.1 Mathematical induction – well ordering principle

2.2 Divisibility in $\mathbb{Z}$: Definition and properties, The division algorithm, Euclidean algorithm (without proof), The greatest common divisor, The least common multiple, relatively prime, Definition of prime numbers, Euclid's lemma

2.3 Fundamental theorem of arithmetic, Definition & properties of congruence's, Residue classes, Fermat's theorem, Addition modulo n, Multiplication modulo n

Unit 3: Matrices and System of Linear Equations [6 Lectures]

3.1 Matrices, Row Echelon and reduced row echelon form, Rank of Matrix

3.2 System of Linear Equations, Matrix form of system of linear equations, Homogeneous and non-Homogeneous system of linear equations, Gauss Elimination, Gauss Jordan Method

3.3 Consistency of system of linear Equations

Unit 4: Complex Numbers [7 Lectures]

4.1 Sums and products, Basic Algebraic properties, Complex Conjugates, Exponential Form, Products and Quotients, De – Moivre's theorem

4.2 Roots of complex number: The nth roots of unity.

Suggested Readings:

1. Introduction to Real Analysis – R.G. Bartle & D. R. Sherbert, John Wiley & Sons Inc, Fourth Edition., 2011.
   Unit1: Chapter1: Section 1.1, 1.3
2. Elementary Number Theory – David M Burton, Tata Mc Graw Hill, Sixth Edition, 2007
   Unit2: Chapter 1: Section 1.1, Chapter2: Section 2.2 to 2.4, Chapter 3: Section 3.1, Chapter 4 : Section 4.1 ,4.2 ,Chapter 5 : Section5.2
3. Elementary Linear Algebra With Application, H. Anton, C Rorres, Wiley Seventh Edition ,1994
   Unit3: Chapter 1: Sections 1.1 to 1.8
4. Complex Variables & Applications, James Ward Brown & Ruel V. Churchill, MC- Graw Hill , 8th Edition, 2008
   Unit 4: Chapter 1: Sections 1 to 11
5. Textbook of Algebra ,S.K.Shah & S.C.Garg,Vikas Publishing House Pvt Ltd.Edition 2017
6. A Foundation Course in Mathematics – Ajit Kumar , S . Kumeresan & BhabaKumar Sarma,Narosa Publication House, 2014

e-resource:

1. **https://math.libretexts.org/Bookshelves/Algebra/Book%3A_Intermediate_Algebra_(OpenStax)/03%3A_Graphs_and_Functions/3.06%3A_Relations_and_Functions**
2. **https://math.libretexts.org/Bookshelves/Precalculus/Book%3A_Trigonometry_(Sundstrom_and_Schlicker)/05%3A_Complex_Numbers_and_Polar_Coordinates/5.01%3A_The_Complex_Number_System**
3. **https://math.libretexts.org/Courses/East_Tennesee_State_University/Book%3A_Differential_Equations_for_Engineers_(Lebl)_Cintron_Copy/3%3A_Systems_of_ODEs/3.2%3A_Matrices_and_linear_systems**

Semester -I	**Paper -II**
Course Code: BSC-MT 102 T	**Title of the Course: Calculus - I**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (Cos):

1. Learn the basic properties of real numbers
2. Learn to define sequence in terms of functions from N to a subset of R and to understand several properties of the real line.
3. Learn limits and Continuity of real valued functions.
4. Apply these concepts for advance study in mathematics

Details of Syllabus:

Unit 1: Real Numbers [10 Lectures]

1.1 The Algebraic and Order Properties of R:

Algebraic properties of R, Order properties of R, Well-Ordering Property of N. Arithmetic Mean-Geometric mean inequality, Bernoulli's inequality.

1.2 Absolute Value and the Real Line:

Absolute value function and its properties, triangle inequality and its consequences, neighborhood of a point on real line.

1.3 The Completeness Property of R:

Definitions of Upper bound, Lower bound, supremum, infimum of subsets of R, completeness property of R.

1.4 Archimedean property

Unit 2. Sequences [04 Lectures]

2.1 Sequences and Their Limits:

Definition and examples of sequences of real numbers, Definition of limit of sequence and uniqueness of limit, Examples on limit of sequence.

2.2 Limits Theorems:

Definition of bounded sequence, every convergent sequence is bounded

Unit 3. Limits [6 Lectures]

3.1 Some elementary real valued functions and their Graphs, domain and range.

3.2 Cluster point, Definition of limit, Definition of limit point of real valued functions, Basic properties of limits, sequential criterion for limits, divergence criteria.

3.3 Algebra of limits, Squeeze theorem

Unit 4. Continuity [10 Lectures]

4.1 Definition of continuous function at a point, Types of Discontinuity, Combination of continuous functions

4.2 Continuous function on an interval

4.3 Properties of a continuous functions on a closed and bounded interval with respect to boundedness, attains its bounds, Location of root theorem (Without proof), Bolzano's intermediate value theorem

Suggested Readings:

1. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley andSons Inc, Fourth Edition, 2011
   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, 2.4.3 to 2.4.6

   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 to3.2.11)

   Unit 3: Chapter 4: Sec. 4.1(4.1.1, 4.1.3 to 4.1.10), Sec. 4.2(4.2.1 to 4.2.8)

   Unit 4: Chapter 5: Sec. 5.1, Sec. 5.2, Sec 5.3
2. Thomas Calculus, Thirteenth edition, Pearson Publication. 2017
   Unit 3: Text book-2: Chapter 1: Sec. 1.1.
3. Introduction to Real analysis, William F.Trench, Free edition, 2010.
4. Calculus of a single variable Ron Larson, Bruce Edwards, tenth edition, 2008
5. Elementary Analysis, The Theory of Calculus, Kenneth A. Ross,

   SpringerPublication, second edition, 1980
6. Calculus and its Applications, Marvin L. Bittinger, David J.

   Ellenbogen andScott A. Surgent, Addison Wesley, tenth edition, 2014

e-resource:

1. **https://math.libretexts.org/Bookshelves/Calculus/Book%3A_Calculus_(OpenStax)**
2. **https://math.libretexts.org/Bookshelves/Calculus/Book%3A_Calculus_(Guichard)**

Semester -I	**Paper -III**
Course Code: BSC-MT 103 P	**Title of the Course:** Mathematics Practical on maxima software
Credits: 1.5	**Total Lectures: 45 Hrs.**

Course Outcomes (Cos):

1. Learn Maxima software
2. Using Maxima software solve the numerical problems.
3. Using Maxima software 2D and 3D graphs.
4. Develop the short programs using Maxima software.

BSC-MT 103 P Practical Based on Paper-I and Paper-II

In Semester-I, we should conduct 3 written practical and 3 practicals on

Maxima software for each paper BSC-MT 101 T and BSC-MT 102 T.

List of Practical

Practical 1: Problems on Unit 1 and Unit 2(Written) from BSC-MT 101 T.

Practical 2: Problems on Unit 3 (Written) from BSC-MT 101 T.

Practical 3: Problems on Unit 4(Written) from BSC-MT 101 T.

Practical 4: Introduction to maxima software for BSC-MT 101 T.

Practical 5: Problems on unit 1 and unit 2 from BSC-MT 101 T using maxima software.

Practical 6: Problems on Unit 3 and Unit 4 from BSC-MT 101 T using maxima software.

Practical 7: Problems on Unit 1 and Unit 2(Written) from BSC-MT 102 T.

Practical 8: Problems on Unit 3 (Written) from BSC-MT 102 T.

Practical 9: Problems on Unit 4(Written) from BSC-MT 102 T.

Practical 10: Introduction to maxima software for BSC-MT 102 T.

Practical 11: Problems on unit 1 and unit 2 from BSC-MT 102 T using maxima software.

Practical 12: Problems on Unit 3 and Unit 4 from BSC-MT 102 T using maxima software.

Note:

1. Practical on maxima software can be performed on computer and android mobiles.

2. Android mobiles are allowed for practical examination on maxima software.

3. Practical examination of 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer)

Semester -II	**Paper -I**
Course Code: BSC-MT 201 T	**Title of the Course:** Analytical Geometry
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcome:

1. Understand reduction of a conic to standard form
2. Visualize & understand geometry of two- and three-dimension objects.
3. Explain the properties of 3-D shapes
4. Understand the lines in 2-D and 3-D

Details of Syllabus:

Unit 1: Analytical Geometry of two Dimensions [05 Lectures]

1.1 Change of axes: Translation & 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

Unit 2: Planes **[**11 Lectures**]**

2.1 Direction Cosines & 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

2.2 Distance of a point from a plane, Distance between parallel planes, System of planes, Two sides of planes, Bisector planes

Unit 3: Lines in three Dimensions **[**05 Lectures**]**

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

Unit 4: Sphere **[**9 Lectures**]**

4.1 Equation of a sphere in different forms, plane section of a sphere
4.2 Equation of a circle, Sphere through a given circle
4.3 Intersection of a sphere and a line, Equation of tangent plane to sphere

Suggested Readings:

1. Analytic Geometry in two and three Dimensions: Von Steuben

Unit1: Chapter 8: Section8.4

2. Analytical Solid Geometry: Shanti Narayan, S Chand & Company Ltd, New Delhi ,1998

   Unit2: Section 1.6,1.7, Section 2.1 to 2.7,

   Unit 3: Section 3.1 to 3.4 ,3.7,

   Unit 4: Section 6.1 to 6.6

3. A text book of Analytical Geometry of three dimensions, P.K. Jain & Khalil Ahmad, Wiley Eastern Ltd .1999.

e-resource:

1. https://open.umn.edu/opentextbooks/textbooks/euclidean-plane-and-its-relatives

Semester -II	**Paper -II**
Course Code: BSC-MT 202 T	**Title of the Course:** Calculus - II
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (Cos):

1. Learn the differentiation and mean value theorems.
2. Learn L'Hospital Rules, Taylor's theorem and Successive Differentiation.
3. Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of first order.
4. Understand linear and non-linear differential equations

Details of Syllabus:

Unit 1: Differentiation **[08 Lectures]**

1.1 The Derivatives:

Definition of the derivative of a function at a point (left and right hand derivatives), every differentiable function is continuous, Rules of differentiation, Caratheodary's theorem (without proof), The chain rule, Derivative of inverse function (without proof, only examples).

1.2 The Mean Value Theorems:

Interior extremum theorem, Mean Value theorems and their Consequences, Intervals of increasing and decreasing of a function, first derivative test for extrema.

Unit 2: L' Hospital Rule and Successive Differentiation **[08 Lectures]**

2.1 Indeterminate forms, L' Hospital Rules (without proof)
2.2 Taylor's theorem: Taylor's theorem and Maclaurin's theorem with Lagrange's form of remainder (Without proof).
2.3 Successive Differentiation: The nth derivative and Leibnitz theorem for successive differentiation.

Unit 3: Riemann Integral **[06 Lectures]**

3.1 Definition Partition,
3.2 Upper sum, Lower Sum
3.3 Definition of Riemann Integral.
3.4 Properties of Riemann Integral
3.5 Fundamental Theorem of Calculus

Unit 4: Ordinary Differential Equations **[08 Lectures]**

4.1 Differential equation, Order of differential equation, Degree of differential equation
4.2 Formation of Differential equation
4.3 General Solution, Particular Solution
4.4 Separable equations.

4.5 Applications

4.5.1 Orthogonal Trajectories

4.5.2 Newton Law of Cooling

Suggested Readings:

1. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley andSons, Inc., Fourth Edition, 2011
   Unit 1: Chapter 6: Sec. 6.1(6.1.1 to 6.1.8), Sec 6.2(6.2.1 to 6.2.8),

   Unit 2: Chapter 6: Sec 6.3(6.3.1 to 6.3.7), Sec 6.4(6.4.1 to 6.4.3).

   Unit 3: Chapter 7: Sec 7.1-7.3
2. Differential Calculus by Shanti Narayan, Tenth Revised Edition. 2005
   Unit 2: Chapter 5: Sec. 5.1 to 5.6.
3. Elementary Differential equations, William F. Trench, E-book (Free download) 1935

   Unit 4: Chapter 2: Sec 2.4 to 2.6.
4. Introduction to Real analysis, William F.Trench, Free edition, 2010.
5. Calculus of a single variable Ron Larson, Bruce Edwards, tenth edition.
6. Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.
7. Calculus and its Applications, Marvin L. Bittinger, David J. Ellenbogen andScott A. Surgent, Addison Wesley, tenth edition.
8. Ordinary and partial Differential equations, M.D. Raisinghania, S. Chand And Company,2009.

e-resource:

1. https://math.libretexts.org/Bookshelves/Analysis/Book%3A_Real_Analysis_(Boman_and_Rogers)
2. https://math.libretexts.org/Bookshelves/Analysis/Book%3A_Mathematical_Analysis_(Zakon)

Semester -II	**Paper -III**
Course Code: BSC-MT 203 T	**Title of the Course:** Mathematics Practical on maxima software
Credits: 1.5	**Total Lectures: 45 Hrs.**

Course Outcomes (Cos):

1. Solve differential equations using Maxima software.
2. Visualize & understand geometry of two- and three-dimension objects.
3. Explain the properties of 3-D shapes
4. Understand the lines in 2-D and 3-D

BSC-MT 203 P Practical Based on Paper-I and Paper-II

In Semester-II, we should conduct 4 written practical and 2 practical on maxima software for each paper BSC-MT 201 T and BSC-MT 202 T.

List of Practical

Practical 1: Problems on Unit 1 (Written) from BSC-MT 201 T.

Practical 2: Problems on Unit 2 (Written) from BSC-MT 201 T.

Practical 3: Problems on Unit 3(Written) from BSC-MT 201 T.

Practical 4: Problems on Unit 4(Written) from BSC-MT 201 T.

Practical 5: Problems on unit 1 and unit 2 from BSC-MT 201 T using maxima software.

Practical 6: Problems on Unit 3 and Unit 4 from BSC-MT 201 T using maxima software.

Practical 7: Problems on Unit 1 (Written) from BSC-MT 202 T.

Practical 8: Problems on Unit 2 (Written) from BSC-MT 202 T.

Practical 9: Problems on Unit 3(Written) from BSC-MT 202 T.

Practical 10: Problems on Unit 4(Written) from BSC-MT 202 T.

Practical 11: Problems on unit 1 and Unit 2 from BSC-MT 202 T using maxima software.

Practical 12: Problems on Unit 3 and Unit 4from BSC-MT 202 T using maxima software.

Note:

1. Practical on maxima software can be performed on computer and android mobiles.

2.Android mobiles are allowed for practical examination on maxima software.

3.Practical examination 25 marks on written problems, 10 marks for problems on

4.maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer.