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)

Proposal to Introduce New Academic Programme

In

S.Y.B.Sc. Mathematics

Implemented from

Academic Year 2022 - 23

Programme Structure and Course Titles: (All academic years)

Sr. No.	Class	Semester	Course Code	Course Title	Credits
1.	S. Y. B. Sc.	III	**BSC-MT 301 T**	Calculus of Several Variables	2
2.	S. Y. B. Sc.	III	**BSC-MT 302 T**	Numerical Methods and Differential Equations	2
3.	S. Y. B. Sc.	III	**BSC-MT 303 P**	Mathematics Practical	2
4.	S. Y. B. Sc.	IV	**BSC-MT 401 T**	Linear Algebra	2
5.	S. Y. B. Sc.	IV	**BSC-MT 402 T**	Vector Calculus	2
6.	S. Y. B. Sc.	IV	**BSC-MT 403 P**	Mathematics Practical	2
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Detail Syllabus:

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar(Autonomous)
Syllabus of S. Y. B. Sc. Mathematics
under
Faculty of Science

Semester – III	**Paper – I**
Course Code: BSC-MT301T	**Title of the Course:Calculus of several variables**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

a. Calculate the limit and examine the continuity of a function at a point.
b. To understand basic concept of derivative as rate of change.
c. Sketch the curves in Cartesian and Polar coordinate systems.
d. Students are able to compute derivatives using the chain rule or total differentials.

Detailed Syllabus:

Unit I: Limits and Continuity [05 Hours]

1.1 Functions of Several Variables: - Functions of two variables, Domain and Range, Graphs, Level Curves,

1.2 Functions of Three or more variables

1.3 Limits and Continuity

Unit II: Partial Derivatives and Differentiability [8 Hours]

2.1 Definition and examples.

2.2 Higher Derivatives, Clairaut's Theorem (Statement Only), Partial Differential Equations, Wave equation.

2.3 Differentiable function, Differentials

2.4 Chain Rule, Homogeneous Functions, Euler's theorem

Unit III: Extreme Values [5 Hours]

3.1 Extreme values of functions of two variables.

3.2 Necessary conditions for extreme values.

3.3 Second Derivative Test (without proof).

3.4 Lagrange Multipliers (with one constraints)

Unit IV: Multiple Integrals [12 Hours]

4.1 Iterated Integrals, Fubini's Theorem (Statement only)

4.2 Double integral over general regions, Change of order of integration for two variables

4.3 Double integral in Polar coordinates

4.4 Triple integrals, Evaluation of triple integrals, Triple integrals in spherical coordinates

4.5 Jacobians, Change of variables in multiple integrals.(without proof)

Suggested Readings:

1. James Stewart, Brooks/Cole, Multivariable Calculus ,Cengage Learning, 7th Edition, 2012.

Unit I: - Chapter 14: Sec- 14.1, 14.2

Unit II: - Chapter 14: Sec- 14.3(except the Cobb-Douglas production function), 14.4 (except Tangent Planes and Linear Approximations), Sec-14.5

Unit III: - Chapter 14: Sec 14.7, 14.8

Unit IV: - Chapter 15: Sec 15.2, 15.3, 15.4, 15.7(without Riemann sum and Application), 15.9, 15.10

2. J. E. Marsden, A. J. Tromba, A. Weinstein, Basic Multivariable Calculus, Springer, (Indian Edition), 2001
3. Shanti Narayan, R.K. Mittal, A Text-book of Vector Calculus,S. Chand and Company, 2010
4. D.V. Widder, Advanced Calculus (2nd Edition), Prentice Hall of India, New Delhi, (1944).
5. John Wiley, T.M. Apostol, Calculus Vol. II, , New York, (2nd Edition), (1967)

Semester- III	Paper - II
Course Code: BSC-MT 302 T	Title of the Course: Numerical Methods and Differential Equations
Credits: 2	Total Lectures: 30 Hrs

Course Outcomes (COs):

a. Demonstrate understanding of common numerical methods and how they are used to
b. Obtain approximate solutions to otherwise intractable mathematical problem.
c. Analyze and evaluate the accuracy of common numerical methods.
d. To understand the basic definition of Linear Differential Equations.

Detailed Syllabus:

Unit I: Solutionof Equations [06 hours]

1.1 Introduction

1.2 Solution of Algebraic and Transcendental Equations
1.3 Method of False Position
1.4 Newton-Raphson Method
1.5 General Iteration Method
1.6 Convergence of Iteration Methods

Unit II: Interpolationand Approximation [06 hours]

2.1 Introduction

2.2 Lagrange Interpolation Formula

2.3 Newton's Divided Difference Interpolation

2.4 Newton's Interpolation Formulae (Forward and Backward Differences)

Unit III: Initial Value Problemsfor Ordinary Differential Equations[08 hours]

3.1 Introduction

3.2 Taylor Series Method
3.3 Modified Euler's Method
3.4 Runge – Kutta Methods (Second and Fourth-Order)

Unit IV: Linear Differential Equations with constant coefficients [8 lectures]

4.1 Constant coefficient homogeneous equations, Characteristic equations, distinct real roots, repeated roots and complex roots. Particular solution. Initial value problem

4.2 The operator $\frac{1}{f(D)}$ and its evaluation for the functions $x^m, e^{ax}, e^{ax}v, xv$ and the operator $\frac{1}{D^2+ba^2}$ acting on $\sin ax$ and $\cos ax$ with proofs.

Suggested Readings:

1. R.K. Jain and S.R.K. Iyenger, Numerical Methods, New Age International (P) Ltd, Publishers, 2009**.**

   Unit I : Chapter 1: section 1.1- 1.1.1, 1.1.3 ,1.1.4, 1.1.5,1.1.6

   Unit II : Chapter 2: Section 2.1, Section 2.2-2.2.1 , 2.2.2

   a. Section 2.3-2.3.1 , 2.3.2

   Unit III: Chapter 4: Section 4.1, Section 4.3- 4.3.1, Section 4.4

2. William F Trench , Elementary Differential Equations with Boundary Value Problems , E book , 2013.

   Unit IV : Chapter 5: Sections 2 to 3

3. C.F. Gerald and O.P. Wheatley, Applied Numerical Analysis, Addison Wesley; 7^{th}edition ,2003.
4. S.S. Sastry, Introductory Methods of Numerical Analysis, 5^{th}edition, Prentice Hall of India, 2012.
5. T. Sauer, Numerical analysis, 3^{rd}edition, Pearson, 2018.

Semester – III	Paper – III
Course Code: BSC-MT303 P	Title of the Course:Mathematics Practical
Credits: 2	Total: 60 Hrs.

List of Practical

Practical 1 : Problems on Unit I(Written) from MT-301T.

Practical 2 : Problems on Unit II (Written) from MT-301T.

Practical 3 : Problems on Unit III (Written) from MT-301T.

Practical 4 : Problems on Unit IV (Written) from MT-301T.

Practical 5 : Problems on unit I and unit II from MT-301T using maxima software.

Practical 6 : Problems on Unit III and Unit IV from MT-301T using maxima software.

Practical 7 : Problems on Unit I (Written) from MT-302T.

Practical 8 : Problems on Unit II (Written) from MT-302T.

Practical 9 : Problems on Unit III (Written) from MT-302T.

Practical 10 : Problems on Unit IV (Written) from MT-302T.

Practical 11 : Problems on unit I and unit II from MT-302T using maxima software.

Practical 12 : Problems on Unit III and Unit IV from MT-302T using maxima software.

Semester – IV	Paper – I
Course Code: MSC-MT401 T	Title of the Course:Linear Algebra
Credits: 2	Total Lectures: 30 Hrs.

Course Outcomes (COs):

a. Understanding a Euclidean Vector Space, orthogonality, cross product

b. Understanding a vector space, subspace, and basis

c. Have thorough understanding of the Linear transformations

d. Understanding a Euclidean Vector Space, orthogonality, cross product

Detailed Syllabus:

Unit I: Euclidean Vector Spaces [08 Hours]

1.1 Vectors in 2-Space, 3-Space, and n-Space

1.2 Norm, Dot Product, and Distance in R^n

1.3 Orthogonality

1.4 The Geometry of Linear Systems

1.5 Cross Product

Unit II: General Vector Spaces [08 Hours]

2.1 Real Vector Spaces

2.2 Subspaces

2.3 Linear Independence

2.4 Coordinates and Basis

2.5 Dimension

2.6 Change of Basis

Unit III: Eigenvalues and Eigenvectors [04 Hours]

3.1 Eigenvalues and Eigenvectors

3.2 Diagonalization

Unit-IV: General Linear Transformations [10Hours]

4.1 General Linear Transformations

4.2 Compositions and Inverse Transformations

4.3 Isomorphism

4.4 Matrices for General Linear Transformations

Suggested Readings:

1.Howard Anton, Chris Rorres, Elementary Linear Algebra, Application Version, Wiley, 11th edition, 2013.

Unit I: Chapter 3
Unit II: Chapter 4
Unit III: Chapter 5
Unit IV: Chapter 8

2.K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall of India, 2nd edition(2014), New Delhi

3.S. Lang, Introduction to Linear Algebra, 2nd edition,1986, Springer-Verlag, New York,Inc.

4. S. H. Friedberg, A. J. Insel and L. E. Spence, Linear Algebra, 4th ed., Prentice Hall, 2003.

5. G. Strang, Linear Algebra and its Applications, Cengage Learning, 15th Re-print edition, 2014.

Semester – IV	Paper – II
Course Code: BSC-MT402T	Title of the Course:Vector Calculus
Credits: 2	Total Lectures: 30 Hrs.

Course Outcomes (COs):

a. Students are able to understand physical interpretation of line integrals.
b. Students are able to understand of a parametric curve as a trajectory described by a position vector.
c. Students are able to determine gradient vector fields and potential functions.
d. Students are able to understand the major theorems Green's theorem, Stokes theorem.

Detailed Syllabus:

Unit I: Vector-Valued Functions [06 Hours]

1.1 Curves in Space, Limits and Continuity, Derivatives and Motion, Differentiation Rules for Vector Function, Vector Functions of Constant Length.
1.2 Integrals of Vector Functions
1.3 Arc Length along a Space Curve, Speed on a Smooth Curve, Unit Tangent Vector.

Unit II: Integrals [10 Hours]

2.1 Line Integral of Scalar Functions, Additivity, Line integral in the Plane.
2.2 Vector Fields, Gradient Fields, Line Integral of Vector Fields, Line Integrals with respect to dx, dy, dz.
2.3 Work done by a Force over a Curve in Space, Flow Integrals and Circulation for Velocity Fields, Flow across the Simple Closed Plane Curve.
2.4 Path Independence, Conservative and Potential Functions.
2.5 Divergence, Two forms for Green's Theorem, Green's Theorem in the Plane (Proof for special regions).

Unit III: Surface Integrals [07 Hours]

3.1 Parameterizations of Surfaces, Implicit surfaces.
3.2 Surface integrals, Orientation of Surfaces.
3.3 Surface Integrals of Vector Fields

Unit IV: Applications of Integrals [07 Hours]

1.1 The Curl Vector Field, Stoke's Theorem (without proof), Conservative Fields and Stoke's Theorem.

1.2 Divergence in three Dimensions, Divergence Theorem (without proof).

1.3 Unifying the Integral Theorems.

Suggested Readings:

1. Hass, Heil, Weir, Thomas' Calculus, Pearson Indian Education Services Pvt. Ltd., (14th Edition) ,2003

   Unit I: Chapter 13: Sec- 13.1, 13.2, 13.3, 13.4

   Unit II: Chapter 16: Sec-16.1, 16.2, 16.3, 16.4

   Unit III: Chapter 16: Sec- 16.5, 16.6

   Unit IV: Chapter 16: Sec- 16.7, 16.8
2. J. E. Mardson, A. J. Tromba, A. Weinstein, Basic Multivariable Calculus, Sppriger Verlag (Indian Edition),2001
3. M.R. Spiegel, Advanced Calculus, Schaum Series, (1963)
4. D.V. Widder, Advanced Calculus, Prentice Hall of India, New Delhi, (Second Edition)
5. (1944),
6. T.M. Apostol, John Wiley, Calculus Vol. II, New York, (Second Edition), (1967).

Semester – IV	Paper – III
Course Code: BSC-MT403P	Title of the Course:Mathematics Practical
Credits: 2	Total: 60 Hrs.

List of Practical

Practical 1 : Problems on Unit I (Written) from MT-401T.

Practical 2 : Problems on Unit II (Written) from MT-401T.

Practical 3 : Problems on Unit III(Written) from MT-401T.

Practical 4 : Problems on Unit IV(Written) from MT-401T.

Practical 5 : Problems on unit I and unit II from MT-401T using maxima software.

Practical 6 : Problems on Unit III and Unit IV from MT-401T using maxima software.

Practical 7 : Problems on Unit I (Written) from MT-402T.

Practical 8 : Problems on Unit II(Written) from MT-402T.

Practical 9 : Problems on Unit III(Written) from MT-402T.

Practical 10 : Problems on Unit IV(Written) from MT-402T.

Practical 11 : Problems on unit I and Unit II from MT-402T using maxima software.

Practical 12 : Problems on Unit III and Unit IV from MT-402T using maxima software.