Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
Autonomous
Course Structure for B.Sc. Mathematics (2022 Pattern)

F. Y. B. Sc. Mathematics

Semester	Course Code	Title of Course	No. of Credits	No. of Lectures
I	USMT111	Algebra	2	36
	USMT112	Calculus-I	2	36
	USMT113	Practical based on USMT111 and USMT112	2	48
II	USMT121	Geometry	2	36
	USMT122	Calculus and Differential Equations	2	36
	USMT123	Practical based on USMT121 and USMT122	2	48

S. Y. B. Sc. Mathematics

Semester	Course Code	Title of Course	No. of Credits	No. of Lectures
III	USMT231	Calculus of Several Variables	3	48
	USMT232	Laplace Transform & Fourier Series	3	48
	USMT233	Practical based on USMT231 and USMT232	2	48
IV	USMT241	Vector Calculus	3	48
	USMT242	Linear Algebra	3	48
	USMT243	Practical based on USMT241 and USMT242	2	48

T.Y.B.Sc Mathematics

Semester	Course Code	Title of Course	No. of Credits	No. of Lectures
V	USMT351	Metric Spaces	3	48
	USMT352	Real Analysis I	3	48
	USMT353	Group Theory	3	48
	USMT354	Ordinary Differential Equation	3	48
	USMT355	Number Theory	3	48
	USMT356(A)	Operation Research	3	48
	USMT356(B)	C Programming	3	48
	USMT357	Practical based on USMT351 and USMT352	2	48
	USMT358	Practical based on USMT353 and USMT354	2	48
	USMT359	Practical based on USMT355 and USMT356	2	48
VI	USMT361	Complex Analysis	3	48
	USMT362	Real Analysis II	3	48
	USMT363	Ring Theory	3	48
	USMT364	Partial Differential Equation	3	48
	USMT365	Lebesgue Integration	3	48
	USMT366(A)	Optimization Techniques	3	48
	USMT366(B)	Python Programming	3	48
	USMT367	Practical based on USMT361, USMT362, and USMT363	2	48
	USMT368	Practical based on USMT364, USMT365, and USMT366	2	48
	USMT369	Mathematics Project	2	48

Equivalence of the old syllabus with the new syllabus

Sem III

Old Course		New Course	
MAT2301	Multivariable Calculus-I	USMT231	Calculus of Several Variables
MAT2302	Laplace Transform & Fourier Series	USMT232	Laplace Transform & Fourier Series
MAT2303	Practical Based on MAT2301 & MAT2302	USMT233	Practical based on USMT231 and USMT232

Academic Year 2023-24

Class S.Y.B.Sc. (Semester – III)

Course Code: USMT 231 **Title of the Course:** Calculus of Several Variables

Course: I **Credit: 3**

No. of lectures: 48

A) Learning Objectives

- To introduce vectors, space curves and their applications.
- To introduce linear approximation of functions of several variables.
- To introduce maximum or minimum point of scalar field under certain conditions.

B) Learning Outcomes

- Student will be able to apply fundamental concepts of multivariable calculus such as limit, continuity and partial differentiation to scalar fields.
- Student will be able to find maximum or minimum point of scalar field under certain conditions.

TOPICS/CONTENT

Unit 1: Vectors and the geometry of space **[08 Lectures]**

1.1 Vectors and its components
1.2 The Dot product and projection
1.3 The Cross product and triple product
1.4 Equations of lines and planes
1.5 Cylinders and quadratic surfaces

Unit 2: Vector functions **[12 Lectures]**

2.1 Vector functions and space curves
2.2 Differentiation of vector functions
2.3 Integration of vector functions
2.4 Arc length
2.5 Curvature
2.6 The normal and binormal vectors
2.7 Motion in space: velocity and acceleration

Unit 3: Partial differentiation **[16 Lectures]**

3.1 Functions of several variables
3.2 Level curves
3.3 Limits and continuity
3.4 Partial derivatives
3.5 Tangent planes
3.6 Linear approximation
3.7 The chain rule
3.8 Implicit differentiation

Unit 4: Optimization of scalar fields **[12 Lectures]**

4.1 Directional derivatives
4.2 The gradient vector
4.3 Maximizing the directional derivative
4.4 Maximum and minimum values
4.5 Lagrange multipliers

Text Book:

James Stewart, *Calculus with early transcendental function*, Cengage learning,

Indian edition, 2008.

Unit 1 – Sections 12.1 to 12.6
Unit 2 – Sections 13.1 to 13.4
Unit 3 – Sections 14.1 to 14.5
Unit 4 – Sections 14.6 to 14.8

Reference Book:

1. Joel Hass, Christopher Heil, Maurice D. Weir, *Thomas' Calculus*, Pearson Indian Education Services Pvt. Ltd., 14th Edition.
2. Jerrold E. Marsden, Anthony J. Tromba, Alan Weinstein, *Basic Multivariable Calculus*, Springer-Verlag, Indian Edition.
3. Robert Wrede, Murry R. Spiegel, *Advanced Calculus*, Schaum's Outline Series, 3rd Edition.
4. Davide V. Widder, *Advanced Calculus*, Prentice-Hall, Inc., 2nd Edition, 1947.
5. Sudhir R. Ghorpade, Balmohan V. Limaye, *A course in Multivariable Calculus and Analysis*, Springer,
6. Tom M. Apostol, *Calculus*: *volume 2*, John Wiley, 2nd Edition, 1967.

Class: S.Y. B. Sc. (Semester- III) **Title of Paper:** Laplace Transform & Fourier Series
Paper Code: USMT232 **Credit:** 3
Paper: II **No. of lectures:** 48

A) Learning Objectives:

- To introduce the concept of Fourier, Laplace Transforms and Inverse Laplace Transform.
- To understand the solution of differential equations using Laplace Transform.
- To understand the use of Laplace transform and Fourier series to solve real world problems.

B) Learning Outcome:

- Students will be able to solve differential equations with initial conditions using Laplace transform
- Students will able to evaluate the Fourier transform of a continuous function and be familiar with its basic properties.

Unit-1: The Laplace Transform: **[18]**

1.1 Definition, Laplace Transform of some elementary functions.
1.2 Some important properties of Laplace Transform.
1.3 Laplace Transform of derivatives, Laplace Transform of Integrals.
1.4 Methods of finding Laplace Transform, Evaluation of Integrals.
1.5 The Gamma function, Unit step function and Dirac delta function.

Unit-2: The Inverse Laplace Transform **[18]**

2.1 Definition, Some inverse Laplace Transform.
2.2 Some important properties of Inverse Laplace Transform.
2.3 Inverse Laplace Transform of derivative, InverseLaplace Transform of integrals.
2.4 Convolution Theorem, Evaluation of Integrals.

Unit-3: Applications of Laplace Transform: **[04]**

3.1 Solution of Ordinary Differential Equations with constant coefficients.

Unit-4: Fourier Series **[08]**

4.1 Definition and examples of Fourier Series.

Text-Book:

1. Schaum's Outline Series - Theory and Problems of Laplace Transform by Murray R. Spiegel.

Unit-1: Chapter 1, Unit-2: Chapter 2, Unit-3: Chapter 3 Unit-4: Chapter 6

Reference Books:

1. Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co. Pvt. Ltd. (1970).Art.12.1
Reference Books:
2. Joel L. Schiff: The Laplace Transforms - Theory and Applications, Springer- Verlag New York 1999.
3. Dyke: An Introduction to Laplace Transforms and Fourier Series, Springer International Edition, Indian Reprint 2005.

Class: S.Y. B. Sc. (Sem- III)**Title of Paper:** Practical based on USMT231 and USMT232
Paper Code: USMT233 **Credit:** 2
Paper: III **No. of lectures:** 48

A. Learning Objectives:

- Understanding the geometric interpretation of multivariable calculus concepts, such as the directional derivative and the divergence of a vector field.
- Apply multivariable calculus techniques to solve problems in physics, engineering, and other sciences, such as finding extrema of a function subject to constraints or computing surface integrals.
- Understanding the Laplace transform as a tool for solving differential equations, including initial value problems and boundary value problems.

B. Learning outcome:

- Being able to use mathematical software to solve multivariable calculus problems and Laplace transforms.
- Being able to communicate mathematical solutions effectively, both verbally and in writing.

Title of experiments:

Calculus of Several Variables:

- Why One Variable Just Isn't Enough!
- Taking Derivatives in Multiple Dimensions: Because Life is Complicated Enough Already
- Calculus for the Multidimensional Thinker: Get Ready to Expand Your Mind
- Calculating the Impossible: Tackling Complex Calculus Problems with Multivariable Calculus
- Calculus in the Real World: How Multivariable Calculus Can Help You Understand the Universe
- "Calculus in the Digital Age: How Software Makes Multivariable Calculus Accessible and Fun"

Laplace Transform & Fourier Series:

- Transforming Your Understanding: Unpacking the Magic of Laplace Transforms and Fourier Series
- The Art of Transformation: Exploring the Beauty of Laplace Transforms and Fourier Series
- From Sine Waves to Signals: Analyzing Real-World Problems with Laplace Transforms and Fourier Series
- Transforming the Future: How Laplace Transforms and Fourier Series are Revolutionizing Engineering and Science
- Mastering Transformations: How Software Tools Make Laplace Transforms and Fourier Series Accessible to All
- Mathemagic: Exploring Laplace Transforms and Fourier Series with Interactive and Animated Software