Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
Autonomous
Course Structure for B.Sc. Mathematics (w.e.f. 2022-23)

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

Old Course		New Course	
MAT 1201	Geometry	USMT121	Geometry
MAT 1202	Calculus-II	USMT122	Calculus and Differential Equations
MAT 1203	Practical based on MAT 1101 and MAT 1102	USMT123	Practical based on USMT121 and USMT122

Class: F.Y.B.Sc. (Semester – II)

Paper Code: USMT121

Paper: I　　　　　　　　　　　　　　　　**Title of the Paper:** Geometry

Credit: 2　　　　　　　　　　　　　　　　**No. of Lectures:** 36

A) Learning Objectives:

- To introduce analytical geometry of 2 and 3 dimensions.
- To study characteristics of 2 and 3 dimensional geometric shapes and mathematical results about their relationships.
- To develop a positive attitude towards Mathematics as an interesting and valuable subject of study.

B) Learning Outcomes:

- Students will be able to perform translations and rotations in 2 dimensions.
- Students will be able to identify lines, planes and spheres in 3 dimensions from equation.
- Students will be able to apply appropriate formulas and tools to determine measurements and use these techniques in real life context and other disciplines.

TOPICS/CONTENTS:

Unit 1: Analytical Geometry of two dimensions　　　　　　[*10 Lectures*]

　　1.1 Change of axes: Translation and Rotation
　　1.2 General equation of second degree in two variables
　　1.3 Reduction to standard form

Unit 2: Planes in three dimensions　　　　　　　　　　　[*10 Lectures*]

　　2.1 Direction cosines and direction ratios
　　2.2 Equation of the plane: Normal form, Transform to the normal form
　　2.3 Planes passing through three non-collinear points
　　2.4 Intercept form
　　2.5 Angle between two planes
　　2.6 Distance of a point from a plane
　　2.7 Distance between parallel planes
　　2.8 System of planes
　　2.9 Two sides of planes
　　2.10 Bisectors of angles between two planes

Unit 3: Lines in three dimensions [*8 Lectures*]

3.1 Equations of lines in symmetric and asymmetric forms
3.2 Line passing through two points
3.3 Angle between a line and a plane
3.4 Coplanar lines
3.5 Skew lines
3.6 Distance of a point from a line

Unit 4: The Sphere [*8 Lectures*]

4.1 Equation of a sphere
4.2 Plane section of a sphere
4.3 Intersection of two spheres
4.4 Sphere through a given circle
4.5 Intersection of a sphere and a line
4.6 Equation of tangent plane

<u>**Text Books:**</u>

1. **Analytic Geometry in Two and Three Dimensions**, *Von Steuben*
   Unit 1: Sections: 8.4.
2. **Analytical Solid Geometry**, *Shantinarayan*, S. Chand and Company Ltd., New Delhi, 1998.
   Unit 2: Sections: 1.6, 1.7, 2.1 to 2.7; **Unit 3:** Sections: 3.1 to 3.4, 3.7;
   Unit 4: Sections: 6.1 to 6.6.

<u>**Reference Books:**</u>

1. Analytical Geometry of 2D and 3D, *P. R. Vittal*, Pearson, 2013.
2. A Textbook of Two Dimensional Geometry, *Sat Pal* and *Harbans Lal*, New Age International Publishers.
3. Textbook of Analytical Geometry of Three Dimensions, *P. K. Jain* and *Khalil Ahmad*, New Age International Publishers.
4. Theory and Problems of Plane and Solid Analytic Geometry, *Joseph H. Kindle*, Schaum's Outline Series.

Class: F.Y. B. Sc. (Semester- II)   **Title of Paper:** Calculus and Differential Equations
Paper Code: USMT122   **Credit:** 2
Paper: II   **No. of lectures:** 36

A) Learning Objectives:

- To understand the idea of differentiation from first principles.
- To understand and work with derivatives as rates of change in mathematical models.
- To understand the use of both graphical and numerical methods.

B) Learning Outcome:

- Students will recognize problem solving techniques appropriate to a given situation including the development of mathematical models.
- Students will able to determine the rate of change of a quantity with respect to another quantity.

Unit 1: Differentiation   **[12 lectures]**

1.1 The Derivative:
The definition of derivative at a point, relationship between differentiability and continuity, Rules for Differentiation, Caratheodory's Theorem (without Proof), The Chain Rule, Derivative of inverse function.
1.2 The Mean Value Theorem:
Interior Extremum Theorem, Rolle's Theorem, Mean Value Theorem, Cauchy Mean Value Theorem, Intervals of increasing and decreasing functions, First Derivative Test for Maxima, Intermediate Value Theorem, Darboux's Theorem.

Unit 2:L'Hospital's Rule and Successive Differentiation   **[14 lectures]**

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

Unit 3: Ordinary Differential Equations   **[10 lectures]**

3.1 First Order Differential Equations: First order linear differential equation, separable equations, Homogeneous equations
3.2 Orthogonal Trajectories: Formation of Differential equation, orthogonal trajectory, Existence and uniqueness of solutions
3.3 Exact Equations: Exact differential equations, Integrating Factors.

Textbooks:

1. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and Sons Inc, Fourth Edition.
   Unit 1: Sec 6.1 and Sec. 6.2, Unit 2: Sec 6.3 and Sec. 6.4
2. Differential Equations by George F. Simmons, Steven G. Krantz, Tata McGrawHill.
   Unit 3: Sec 1.3 to Sec 1.8

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.
5. Ordinary and Partial Differential Equation, by M.D.Raisinghania, S.Chand and Company LTD, 2009.
6. Daniel Murray, Introductory Course in Differential Equations, Orient Longman

Class: F.Y. B. Sc. (Semester- II) **Title of Paper:** Practical Based on USMT121 & USMT122
Paper Code: USMT123   **Credit:** 2
Paper: III   **No. of lectures:** 48

A) Learning Objectives:
- Improve problem-solving ability in Geometry of two and three dimensions
- Improve problem-solving ability in Differentiation and Differential equations
- Use of ICT tools to learn Mathematics.

B) Learning Outcome:
- Lead students to learn and improve their understanding of Mathematics.
- Students will be able to analyze geometrical properties of two- and three-dimensional shapes and develop mathematical arguments about geometric relationships. Also, they will be to solve and apply derivatives of different functions.

Title of Experiments:

1. Analytical Geometry of two dimensions
2. Planes in three dimensions
3. Lines in three dimensions
4. Sphere
5. History of Geometry
6. Geometry using Maxima Software
7. Differentiation
8. Mean Value Theorem
9. L'Hospital's Rule
10. Successive Differentiation
11. Ordinary Differential Equations
12. Differentiability using Maxima Software