Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

Autonomous

Course Structure for B.Sc. Mathematics

F. Y. B. Sc. Mathematics

Semester	Paper Code	Title of Paper	No. of Credits
I	MAT1101	Algebra	2
	MAT1102	Calculus-I	2
	MAT1103	Practical Based on MAT1101 & MAT1102	2
II	MAT1201	Geometry	2
	MAT1202	Calculus-II	2
	MAT1203	Practical Based on MAT1201 & MAT1202	2

S. Y. B. Sc. Mathematics

Semester	Paper Code	Title of Paper	No. of Credits
III	MAT2301	Multivariable Calculus-I	3
	MAT2302	Laplace Transform & Fourier Series	3
	MAT2303	Practical Based on MAT2301 & MAT2302	2
IV	MAT2401	Linear Algebra	3
	MAT2402	Multivariable Calculus-II	3
	MAT2403	Practical Based on MAT2401 & MAT2402	2

SYLLABUS (CBCS) FOR F. Y. B. Sc. MATHEMATICS
(w.e.f. June, 2019)

Academic Year 2019-2020

Class : F.Y. B. Sc. (Semester- II)
Paper Code : MAT1201
Paper : I **Title of Paper** : Geometry
Credit : 2 **No. of lectures:** 36

Unit 01: Analytical Geometry of two dimensions [*9 Lectures*]

- Locus of points, Change of axes (Translation and Rotation).
- General equation of second degree in x and y, Centre of conic.
- Reduction to standard form: length of axes, equation of axes, foci, eccentricity, vertex, equation of directrix and latus rectum.
- General equation representing parabola.

Unit 02: Planes in three dimensions [*9 Lectures*]

- Rectangular Cartesian coordinates of a point in space: Orientation of axes, Coordinates of a point, Direction cosines, Angle between two lines (using direction cosines).
- Equation of first degree in x, y, z, Normal form of the equation of a plane.
- Determination of a plane under given conditions.
- System of planes, Two sides of planes.
- Length of the perpendicular form a point to a plane, Bisectors of angles between two planes.
- Joint equation of two planes.

Unit 03: Lines in three dimensions [*9 Lectures*]

- Equations of lines: In terms of direction cosines and a point on it, equations of lines though two points, Symmetrical and asymmetrical form of equations of line, Angle between the line and plane.
- The condition that a given line lie in a given plane, the condition that two lines are coplanar.
- Sets of conditions which determine a line.
- Skew lines, Shortest distance between two skew lines, length of perpendicular from a point to the line.

Unit 04: The Sphere [*9 Lectures*]

- Definition and equation of the sphere in various forms.
- Plane section of sphere, intersection of two sphere.
- Equation of a circle, sphere through a given circle, intersection of a sphere and a line.
- Equation of a tangent plane.

Text Books:

1. George Thomas, Ross Finney, Calculus and Analytical Geometry, Pearson Education (9^{th} Edition)
   Chapter – 9
2. Shanti Narayan, Mittal, Analytical Solid Geometry, S. Chand and Company Ltd, 1998.
   Chapters – 1, 2, 3, 6.

Reference Books:

1. E. H. Askwyth, The Analytical Geometry of the conic section.
2. P. K. Jain, Khalil Ahmed, A text book of Analytical Geometry of three dimensions, Wiley Estern Ltd, 1999.
3. L. P. Eisenhart, Coordinate Geometry, The World Press Pvt. Ltd.
4. Gordan Fuller, Robert Parker, Analytical Geometry and Calculus, D. Van Nastrand.

Class : F.Y. B. Sc. (Semester- II)
Paper Code : MAT1202
Paper : II **Title of Paper :** Calculus II
Credit : 2 **No. of lectures:** 36

Unit 1. Continuous Functions: [*18 Lectures*]

i) Continuous Functions

ii) Properties of Continuous Functions

iii) Uniform Continuity

iv) Limits of funtions

Unit 2.Differentiation: [*18 Lectures*]

i) Basic properties of the Derivative

ii) The Mean Value Theorem

iii) L'Hospital Rules

iv) Successive Differentiation , Leibnitz theorem

iv) Taylor's Theorem& Maclaurin's Series

Text Book: Elementary Analysis (Second Edition), Kenneth A. Ross, Springer

Sections: 17 to 20, 28 to 31

Reference Books:

1. A Course in Calculus and Analysis by SudhirGhorpade and BalmohanLimaye, Springer 2006.

2. Principles of Mathematical Analysis , W. Rudin, Third Edition, McGraw Hill, 1976

3.Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons,2002

4. Mathematical Analysis , Tom M. Apostol.

Class : F.Y. B. Sc. (Semester- II)
Paper Code : MAT1203
Paper : III **Title of Paper** :Practical based on MAT1201 & MAT1202
Credit : 2 **No. of lectures:** 48

Title of Experiments

Geometry:

1. Analytical geometry in 2 dimensions I
2. Analytical geometry in 2 dimensions II
3. Planes in 3 dimensions
4. Lines in 3 dimensions
5. Sphere
6. Geometry using Maxima software
7. Miscellaneous

Calculus II:

1. Continuous functions I
2. Continuous functions II
3. Differentiation I
4. Differentiation II
5. Taylor's Series
6. Calculus using Maxima software
7. Miscellaneous

Choice Based Credit System Syllabus (2019 Pattern)

Class: F.Y.B.Sc. (Semester – II)
Course Code: MAT 1201
Course: 1 **Title of the Course:** Geometry
Credit: 2 **No. of Lectures:** 36

A) Course Objectives:

1. Understand an apply the concept of locus of points in analytical geometry.
2. Master the techniques of translating and rotating coordinate axes.
3. Analyze and determine the centre of a conic.
4. Apply techniques for reducing equation to standard form.
5. Acquire skills in working with rectangular Cartesian coordinates in three dimensions.
6. Learn to find direction cosines and angle between lines using direction cosines.
7. Master the determination of planes under given conditions and understand the concept of system of planes
8. Develop the ability of finding the shortest distance between skew lines and length of perpendicular from point to line.
9. Understand the fundamental concepts and properties of spheres.
10. Develop the ability to determine and apply the equation of a tangent plane to a sphere, demonstrating a clear understanding of this geometric concept.

B) Course Outcomes:

1. Students will be able to demonstrate proficiency in performing translations and rotations of coordinate axes.
2. Students will be able to reduce equations to standard forms and determine various properties associated with them.
3. Students will understand rectangular Cartesian coordinates in three dimensions and use them in various scenarios.
4. Students will be able to calculate direction cosines and angle between lines using coordinate geometry techniques.
5. Students will be able to find the shortest distance between skew lines and length of perpendicular from points to lines in three dimensions.
6. Students will be able to analyze plane sections of spheres and solve problems involving the intersection of two spheres.
7. Students will be able to determine and apply the equation of tangent plane to a sphere, illustrating a high-level proficiency in this advanced geometric concept.

Mapping of Program Outcomes with Course Outcomes

Class: FYBSc (Sem II) **Subject:** Mathematics
Course: Geometry **Course Code:** MAT1201
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	2							1
CO 2	3	2							
CO 3	2	3			1				1
CO 4	3	2							
CO 5	3	2							
CO 6	3	3				1		1	
CO 7	3	2		1	2				1

Justification for the mapping

PO1: Disciplinary Knowledge
CO1: Student will demonstrate proficiency in performing translations and rotations of coordinate axes.
CO2: Student will be able to determine the nature of conic and reduce its equation to standard form.
CO3: Student will be able to use three-dimensional Cartesian coordinate system in different scenarios.
CO4: Student will be able to calculate direction cosines and angle between lines using coordinate geometry techniques.
CO5: Student will be able to understand difference between coplanar and skew lines.
CO6: Student will understand intersection of sphere with line, plane and sphere.
CO7: Student will apply the equation of tangent plane to a sphere, illustrating a high-level proficiency in this advanced geometric concept.

PO2: Critical Thinking and Problem Solving
CO1: Student will apply their knowledge of coordinate geometry to solve problems involving the translation and rotation of geometric figures.
CO2: Student will apply their knowledge of conic section to solve problems involving the manipulation of geometric figures.
CO3: Student will be able to use three-dimensional Cartesian coordinate system in different scenarios.
CO4: Student will apply the calculation of direction cosines and angles between lines in coordinate geometry to enhance their critical thinking and problem-solving skills by understanding spatial relationships and solving geometric problems in three-dimensional space.

CO5: Mastering spatial reasoning in three dimensions enhances a student's capacity to analyze intricate geometric relationships, crucial for solving real-world problems across diverse fields.
CO6: Exploring plane sections of spheres sharpens critical thinking through in-depth analysis of intricate three-dimensional relationships, honing spatial reasoning and mathematical problem-solving skills.
CO7: Proficiency in tangent plane equations for spheres sharpens critical thinking and problem-solving, illuminating local behavior and spatial relationships in environmental contexts.

PO4: Research-related skills and Scientific temper
CO7: Proficiency in spherical geometry empowers student to analyze Earth's curvature, navigate celestial objects, and process geospatial data, enhancing their scientific acumen in three-dimensional studies.

PO5: Trans-disciplinary Knowledge
CO3: Student will use three-dimensional Cartesian geometry to analyze and model complex physical phenomena in fields like physics, engineering, and computer science, enabling them to solve real-world problems involving spatial relationships and dimensions.
CO7: Proficiency in spherical geometry empowers student to navigate and analyze complex spatial phenomena in diverse fields like physics, astronomy, geography, and geology.

PO6: Personal and Professional Competence
CO6: Spherical geometry enriches competence with spatial reasoning, problem-solving, and a 3D perspective, vital in astronomy, navigation, and computer graphics.

PO8: Environment and Sustainability
CO6: Proficiency in spherical geometry enhances comprehension and analysis of global environmental phenomena, enabling accurate measurements and precise modeling for sustainable solutions.

PO9: Self-directed and Life-long Learning
CO1: Analytical geometry in two dimensions cultivates spatial reasoning for independent problem-solving across diverse fields, promoting lifelong learning.
CO3: Proficiency in three-dimensional Cartesian coordinates empowers student with a crucial spatial analysis toolset, fostering lifelong learning and enabling precise problem-solving in real-world contexts.
CO7: Studying spherical geometry fosters a broader understanding of spatial relationships, enhancing self-directed and life-long learning by providing a unique perspective on non-Euclidean geometries and applications in fields like astronomy and navigation.

Class: F.Y.B.Sc. (Semester – II)
Course Code: MAT 1202
Course: 2 **Title of the Course:** Calculus-II
Credit: 2 **No. of Lectures:** 36

Course Outcomes:

CO1 Students will able to apply definition of continuity to pure and applied problems.
CO2 Students will able to draw the graphs of algebraic and transcendental functions considering limits and continuity.
CO3 Students will able to understand definition of differentiation using limits.
CO4 Students will apply these concepts for advanced study in Mathematics (Real Analysis, Complex Analysis, topology)
CO5 Students can develop the theoretical as well as applied, computational skills and gains the confidence in proving theorems and solving problems.
CO6 Students will able to relate graphs and theoretical concepts in calculus efficiently.
CO7 Students will apply continuity and differentiation concept in physical, chemical, and biological sciences.

Mapping of Program Outcomes with Course Outcomes

Class: FYBSc (Sem II) **Subject:** Mathematics
Course: Calculus-II **Course Code:** MAT1202
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes(POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	2							
CO 2	3	2		2	2				
CO 3	3	2		2					
CO 4	3	2							
CO 5	3			2					
CO 6	3	2		2					
CO 7	3			2	2	2			2

Justification for the mapping

PO 1: Disciplinary Knowledge:

All of these COs contribute to development of students disciplinary knowledge.For example,CO1, CO2,CO3 requires to think students critically to apply differentiation,behaviour of functions in various fields .

CO5,CO6 and CO7 requires to develop deep understanding of continuity, limits of a function , differentiation and use it to solve real world problems.

PO2:Critical Thinking and Problem Solving:

CO1,CO2 and CO4 requires to development of students knowledge of derivative,Mean Value theorems , integration to find critical points of a function,to solve problems related to accuracy etc.

CO3, CO6 contribute to development of students understanding to solve real world problems in different fields by using behaviour of functions.

PO4: Research-related skills and Scientific temper:

CO2,CO3,CO5,CO6,CO7 requires to develop students research related skills.Students will able to apply the tools of calculus to various real world problems in different areas.

PO5:Trans-disciplinary Knowledge:

CO7:Students will apply mathematical concept such as Continuity,limits and differentiation. These concepts are useful in many different fields such as Physics,engineering ,chemistry and economics.

PO6:Personal and professional competence:

CO7 requires to demonstrate the students ability to apply mathematical concept such as continuity and derivative in practical manner. This ability is essential for personal and professional development.

PO9:Self-directed and Life-long learning:

CO7:Students will demonstrate the ability to apply the concept of calculus and differential equations in practical context. This ability will enable them to continue learning and developing skills throughout life.

Class : F.Y. B. Sc. (Semester- II)
Paper Code: MAT1203
Paper : III **Title of Paper :**Practical based on MAT1201 & MAT1202

Course Objectives for Mathematics Practical:

Geometry:

- Develop proficiency in applying algebraic methods to solve problems in two-dimensional and three-dimensional geometry.
- Gain practical skills in visualizing and manipulating geometric objects in space.
- Master the use of Maxima software to solve geometric problems and visualize mathematical concepts.
- Strengthen spatial reasoning and analytical thinking abilities through geometrical exercises.

Calculus II:

- Deepen the understanding of continuity and differentiability of functions.
- Acquire practical skills in performing differentiation techniques and exploring their applications.
- Gain familiarity with Taylor's series and its role in approximating functions.
- Utilize Maxima software to perform symbolic and numerical calculations in calculus.
- Enhance problem-solving abilities through diverse calculus applications.

Course Outcomes for Mathematics Practical:

Geometry:
CO1: Analyze and manipulate lines, circles, conics, and other geometric shapes using algebraic equations.
CO2: Determine the intersection points, distances, and other relationships between geometric objects in two and three dimensions.
CO3: Visualize and represent geometric concepts using graphical techniques and Maxima software.
CO4: Apply geometric principles to solve practical problems in diverse fields.

Calculus II:
CO5: Recognize and evaluate continuous functions based on their properties and graphical representations.
CO6: Master differentiation techniques such as product rule, chain rule, and implicit differentiation, and apply them to solve optimization problems.
CO7: Explain and utilize Taylor's series to approximate functions and analyze their behavior.
CO8: Solve differential equations and apply calculus concepts to problems in physics, engineering, and other disciplines.
CO9: Leverage Maxima software to perform symbolic and numerical differentiation, integration, and other calculus operations.

	Programme Outcomes (POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	3				2			3
CO 2	3	3				2			3
CO 3		3	2						3
CO 4					2				3
CO 5	3	3				2			3
CO 6	3	3		2		2			3
CO 7		3							3
CO 8	3	3		2	2				3
CO 9			2			2			3

PO 1: Disciplinary Knowledge:
COs 1, 2, 5, 6, and 8 involve analyzing and manipulating equations, geometric objects, and calculus concepts. Students gain practical experience applying these concepts to solve problems.

PO2:Critical Thinking and Problem Solving:
COs 1, 2, 3, 5, 6, 7 and 8 require analyzing situations, formulating solutions, and applying mathematical tools to solve problems in various contexts. Students learn to think critically, reason logically, and develop creative approaches to tackling complex problems.

PO 3: Communication and Team work:
COs 3 and 9 involve visualizing and representing mathematical concepts using graphs, diagrams, and software. Students may collaborate on group projects or discussions, presenting their findings and interpretations.

PO4: Research-related skills and Scientific temper:
COs 6 and 8 involve applying calculus concepts to real-world problems in other disciplines, like physics and engineering. Students learn to analyze data, draw conclusions, and develop a scientific approach to investigating mathematical applications.

PO5:Trans-disciplinary Knowledge:
COs 4 and 8 showcase the applicability of geometric and calculus principles in diverse fields like architecture, computer graphics, and optimization problems. Students learn to utilize mathematical tools to solve problems beyond pure mathematics.

PO6:Personal and professional competence:
COs 1, 2, 5, 6 and 9 require independent work, applying algorithms, and analyzing results. Students develop time management skills, self-reliance, and the ability to work effectively under pressure.

PO9:Self-directed and Life-long learning:
All COs promote independent learning, exploration, and curiosity. Students learn to actively seek information, solve new problems, and adapt to new mathematical concepts, fostering lifelong learning skills.