Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati

(*Autonomous*)

Three/Four Year Honours/Honours with Research B.Sc. Degree Program in Mathematics (Faculty of Science)

CBCS Syllabus

FYBSc (Mathematics)

For Department of Mathematics

NEP-2.0

Choice Based Credit System Syllabus

(2024 Pattern)

(As Per NEP-2020)

To be implemented from Academic Year 2024-2025

Title of the Programme: F.Y.B.Sc. (Mathematics)

Preamble

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Mathematics and related subjects, the Board of Studies in Mathematics at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of F.Y.B.Sc. Mathematics, which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and 13th March, 2024 and Circular of SPPU, Pune dated 31st May 2023.

A Mathematics degree equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Graduates in Mathematics find opportunities in various fields, including Financial Planner, Market Research Analyst, Data Scientist, teaching, Insurance underwriter, operations research analyst, software developer, and many other domains. After graduating with a degree in mathematics, students can embark on a multitude

of rewarding and diverse career paths. The analytical and problem-solving skills honed during their studies equip them with a strong foundation for success in various fields. Many graduates choose to pursue careers in academia and research, where they can contribute to the advancement of mathematical knowledge through teaching, publishing papers, and conducting ground breaking research. Others may opt for careers in the financial sector, such as investment banking or actuarial science, utilizing their expertise in mathematical modelling and statistical analysis to make informed decisions and manage risks. Additionally, the field of data science offers abundant opportunities for mathematics graduates, as they possess the ability to extract meaningful insights from complex data sets and develop algorithms that drive innovation in industries like technology, healthcare, and marketing. Moreover, mathematics graduates can find fulfilling careers in engineering, cryptography, software development, and operations research, to name just a few areas where their mathematical skills are highly sought after. Overall, a degree in mathematics opens doors to a wide range of intellectually stimulating and financially rewarding professions, allowing graduates to make significant contributions to society and thrive in a rapidly evolving world.

Overall, revising the Mathematics syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Level/ Difficulty	Sem	Subject DSC-1	Subject DSC-2	Subject DSC-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
4.5/100	I	2(T)+2(P)	2(T)+2(P)	2(T)+ 2(P)	2(T)	2 (T/P)	2(T) (Generic)	2(T)	2(T)	--	**22**
	II	2(T)+2(P)	2(T)+2(P)	2(T)+2(P)	2(P)	2 (T/P)	--	2(T)	2(T)	2(T	**22**
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor **Continue option**: Student will select one subject among the (subject 1, subject 2 and subject 3) as major and other as minor and third subject will be dropped.											

Level/ Difficulty	Sem	Credits Related to Major				Minor	--	GE/OE	SEC	IKS	AEC	VEC	CC	Total
		Major Core	Major Elective	VSC	FP/OJT/CEP/RP									
5.0/200	III	4(T)+2(P)	--	2 (T/P)	2(FP)	2(T)+2(P)	--	2(T)	--	2(T)	2(T)	--	2(T)	**22**
	IV	4(T)+2(P)	--	2 (T/P)	2(CEP)	2(T)+2(P)	--	2(P)	2 (T/P)	--	2(T)	--	2(T)	**22**
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4credits core NSQF course/Internship OR Continue with Major and Minor														
5.5/300	V	8(T)+4(P)	2(T)+2(P)	2 (T/P)	2(FP/CEP)	2(T)	--	--	--	--	--	--	--	**22**
	VI	8(T)+4(P)	2(T)+2(P)	2 (T/P)	4 (OJT)	--	--	--	--	--	--	--	--	**22**
Total 3Years		**44**	**8**	**8**	**10**	**18**	**8**	**8**	**6**	**4**	**8**	**4**	**6**	**132**
Exit option: Award of **UG Degree in Major** with 132 credits OR Continue with Major and Minor														
6.0/400	VII	6(T)+4(P)	2(T)+2 (T/P)	--	4(RP)	4(RM)(T)	--	--	--	--	--	--	--	**22**
	VIII	6(T)+4(P)	2(T)+2 (T/P)	--	6(RP)	--	--	--	--	--	--	--	--	**22**
Total 4Years		**64**	**16**	**8**	**22**	**22**	**8**	8	**6**	**4**	**8**	**4**	**6**	**176**
Four Year **UG Honours with Research Degree** in Major and Minor with 176 credits														
6.0/400	VII	10(T)+4(P)	2(T)+2 (T/P)	--	--	4(RM) (T)	--	--	--	--	--	--	--	**22**
	VIII	10(T)+4(P)	2(T)+2 (T/P)	--	4 (OJT)	--	--	--	--	--	--	--	--	**22**
Total 4Years		**72**	**16**	**8**	**14**	**22**	**8**	8	**6**	**4**	**8**	**4**	**6**	**176**
Four Year **UG Honours Degree** in Major and Minor with 176 credits														

T = Theory **P** = Practical **DSC** = Discipline Specific Course **OE** = Open Elective **SEC** = Skill Enhancement Course
IKS = Indian Knowledge System **AEC** = Ability Enhancement Course **VEC** = Value Education Course **CC** = Co-curricular Course
VSC= Vocational Skill Course **OJT**= On Job Training **CEP**= Community Engagement Project **FP**= Field Project **RP**= Research Project

Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati (Autonomous)

NEP-2.0

Course Structure for F.Y.B.Sc. (2024 Pattern as per NEP-2020)

Sem	Course Type	Course Code	Course Title	Theory / Practical	Credits
	DSC-I (General)	-101-GEN		T	02
		-102-GEN		P	02
	DSC-II (General)	-101-GEN		T	02
		-102-GEN		P	02
	DSC-III (General)	MAT-101-GEN	Algebra and Calculus	T	02
		MAT-102-GEN	Algebra and Calculus Practical with Python	P	02
	Open Elective (OE)	MAT-103-OE	Basic Mathematics	T	02
	Skill Enhancement Course (SEC)	MAT-104-SEC	Scilab Software	P	02
	Ability Enhancement Course (AEC)	ENG-104-AEC		T	02
	Value Education Course (VEC)	ENV-105-VEC		T	02
	Generic Indian Knowledge System (GIKS)	GEN-106-IKS		T	02
				Total Credits Semester-I	**22**
II	DSC-I (General)	-151-GEN		T	02
		-152-GEN		P	02
	DSC-II (General)	-151-GEN		T	02
		-152-GEN		P	02
	DSC-III (General)	MAT-151-GEN	Geometry and Differential Calculus	T	02
		MAT-152-GEN	Geometry and Differential Calculus Practical with Geogebra	P	02
	Open Elective (OE)	MAT -153-OE	Applied Mathematics	P	02
	Skill Enhancement Course (SEC)	MAT -154-SEC	Maxima Software	P	02
	Ability Enhancement Course (AEC)	ENG-154-AEC		T	02
	Value Education Course (VEC)	COS-155-VEC		T	02
	Co-curricular Course (CC)	YOG/PES/CUL/NSS/NCC-156-CC	To be selected from the CC Basket	T	02
				Total Credits Semester-II	**22**
				Cumulative Credits Semester I + Semester II	**44**

Programme Specific Outcomes (PSOs)

PSO 1-Proficiency in Mathematical Concepts: Graduates will have a deep understanding of fundamental mathematical concepts and theories across various branches of mathematics, including calculus, algebra, geometry, probability, and statistics.

PSO 2-Problem-Solving Skills: Graduates will possess strong problem-solving skills and the ability to apply mathematical principles to real-world situations. They can analyze complex problems, develop logical reasoning, and devise creative strategies to find solutions.

PSO 3-Mathematical Modeling: Graduates will be proficient in mathematical modeling, which involves using mathematical techniques to describe and analyze real-world phenomena. They can formulate and solve mathematical models to address problems in diverse fields, including physics, economics, engineering, and social sciences.

PSO4-Computational and Analytical Skills: Graduates will be skilled in using computational tools and software, such as programming languages, statistical software, and mathematical modeling software. They can leverage these tools to perform numerical analysis, data visualization, and simulations**.**

PSO 5-Communication and Presentation: Graduates will possess effective communication skills, both written and oral, to convey complex mathematical ideas and results to both technical and non-technical audiences. They can present mathematical arguments, proofs, and findings in a clear and concise manner.

PSO 6-Research and Inquiry: Graduates will have the ability to engage in mathematical research and inquiry. They can critically evaluate existing mathematical theories, develop new mathematical models, and contribute to the advancement of mathematical knowledge through independent research or collaborative projects.

PSO 7-Interdisciplinary Collaboration: Graduates will be adept at collaborating with professionals from other disciplines, such as scientists, engineers, economists, and computer scientists. They can effectively communicate and work in multidisciplinary teams to solve complex problems that require mathematical expertise.

PSO 8-Lifelong Learning: Graduates will have developed a strong foundation for lifelong learning in mathematics. They will have the skills to stay abreast of new developments in the field, adapt to emerging technologies and methodologies, and continue their professional growth through self-directed study or advanced academic pursuits.

PSO 9-Advanced Mathematical Techniques: Graduates will have a command of advanced mathematical techniques, such as differential equations, mathematical analysis, linear algebra, number theory, and optimization. They can apply these advanced mathematical tools to solve complex problems and contribute to specialized areas of research.

PSO 10-Mathematical Software Development: Graduates will possess programming skills and the ability to develop mathematical software or algorithms. They can design, implement, and optimize software applications that facilitate mathematical calculations, simulations, data analysis, and modeling.

PSO 11-Mathematical Education and Teaching: Graduates interested in pursuing a career in education will have the necessary skills to teach mathematics at various levels. They can design and deliver effective lessons, develop curriculum materials, and assess student progress in mathematics. They can also inspire and motivate students to develop an appreciation for the subject.

PSO 12-Mathematical Finance and Risk Analysis: Graduates with an interest in finance and economics will have specialized knowledge in mathematical finance and risk analysis. They can apply mathematical models, stochastic calculus, and statistical methods to analyze financial markets, manage investment portfolios, assess risk, and make informed financial decisions.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics (2024 Pattern)

Name of the Programme : B.Sc. Mathematics
Program Code : USMT
Class : F.Y.B.Sc.
Semester : II
Course Type : Theory
Course Name : Geometry and Differential Calculus
Course Code : MAT-151-GEN
No. of Teaching Hours : 30
No. of Credits : 2

Course Objectives:

1. Gain proficiency in the concepts of the locus of points, change of axes, and the general equation of the second degree.
2. Identify the center of conics and reduce their equations to standard forms, enhancing their understanding of conic sections.
3. Develop skills in working with rectangular Cartesian coordinates in space and understanding direction cosines and angles between lines.
4. Master the equations of planes, including normal form and first-degree equations in x, y, z, and determine planes under various conditions.
5. Learn to write equations of lines in symmetric and asymmetric forms, calculate angles between lines and planes, and identify coplanar lines.
6. Define and derive the equations of spheres in various forms, and analyze their plane sections and intersections with other spheres.
7. Learn the definition and properties of the Riemann integral and determine the integrability of functions.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Use analytical geometry techniques to solve problems involving the locus of points and the transformation of coordinate axes.
CO2: Analyze the general equation of the second degree and reduce it to its standard form to identify different conic sections.
CO3: Solve problems involving rectangular Cartesian coordinates, direction cosines, and the angles between lines in space.
CO4: Formulate and analyze equations of planes in various forms, including the normal form and under given conditions.
CO5: Develop the ability to write and interpret equations of lines in space, calculate angles between lines and planes, and determine coplanarity.
CO6: Understand the properties and equations of spheres, and solve problems involving plane sections and intersections of spheres.
CO7: Understand and apply the concept of Riemann integration to determine the integrability of functions and calculate integrals.

Topics and Learning Points

	Teaching Hours
Unit 1: Analytical Geometry of two dimensions	**3**
1.1 Locus of points and change of axes (Translation and Rotation)	
1.2 General equation of second degree	
1.3 Centre of conic	
1.4 Reduction of equation of conic to its standard form	
Unit 2: Planes in three dimensions	**4**
2.1 Rectangular Cartesian coordinates of points in space	
2.2 Direction cosines and angle between two lines	
2.3 Equation of first degree in x, y, z.	
2.4 Normal form of equation of plane	
2.5 Determination of plane under given conditions	
Unit 3: Lines in three dimensions	**4**
3.1 Equations of lines (Symmetric and asymmetric forms)	
3.2 Angle between the line and a plane	
3.3 Coplanar lines	
Unit 4: The Sphere	**4**
4.1 Definition and equation of the sphere in various forms	
4.2 Plane section of the sphere	
4.3 Intersection of two spheres	
Unit 5: Continuity	**4**
5.1 Continuous Functions	
5.2 Continuous Functions on Intervals	
Unit 6: Differentiation	**8**
6.1 The Derivative	
6.2 The Mean Value Theorem	
6.3 L'Hospital Rules	
Unit 7: Riemann Integration	**3**
7.1 Riemann Integral	
7.2 Riemann Integrable Functions	

Text Books:

1. Von Steuben, Analytic Geometry in two and three dimensions **Unit 1**
2. Shanti Narayan and P. K. Mittal, Analytical Solid Geometry, S. Chand **Unit 2**, **Unit 3 and Unit 4**
3. Introduction to Real Analysis by Robert.G. Bartle and Donald.R. Sherbert, John Wiley and Sons Inc, Fourth Edition. **Unit 5, Unit 6 and Unit 7**

Reference Books:

1. George Thomas and Ross Finney, Calculus and Analytical Geometry, Pearson Education.
2. P. K. Jain and Khalil Ahmed, A text book of Analytical Geometry of three dimensions, Wiley Eastern Ltd.
3. Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem II) **Subject:** Mathematics
Course: Geometry and Differential Calculus **Course Code:** MAT-151-GEN
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	3	3	3	3	3
PO2	2	2	3	2	2	2	3
PO3	1	1	1	1	1	1	2
PO4	2	3	3	3	3	3	2
PO5	3	3	3	3	3	3	3
PO6	1	1	1	1	1	1	2
PO7	2	2	2	2	2	2	3
PO8	3	3	3	3	3	3	3
PO9	1	1	2	1	1	1	2
PO10	1	1	1	1	1	1	1
PO11	1	1	1	1	1	1	1
PO12	2	2	2	2	2	2	3
PO13	1	1	1	1	1	1	1

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding
Solid foundation in mathematical concepts and geometry.
PO2: Practical, Professional and Procedural Knowledge
Application of coordinate geometry and integration methods.
PO3: Entrepreneurial Mindset and Knowledge
Limited relevance to entrepreneurship, more relevant to problem-solving.
PO4: Specialized Skills and Competencies
Geometrical problem-solving skills and integration techniques.
PO5: Capacity for Application, Problem-Solving and Analytical Reasoning
Strong emphasis on problem-solving in geometry and calculus.
PO6: Communication Skills and Collaboration
Communication of mathematical ideas in geometric and integral contexts.
PO7: Research-related Skills
Opportunities for geometric and integral research.
PO8: Learning How to Learn Skills
Continuous learning through advanced geometrical and integration concepts.
PO9: Digital and Technological Skills
Some use of technology in solving geometric and integrative problems.
PO10: Multicultural Competence, Inclusive Spirit and Empathy
Limited direct relevance to multicultural aspects.
PO11: Value Inculcation and Environmental Awareness
Minimal direct link to values and environmental issues.
PO12: Autonomy, Responsibility and Accountability
Encourages independent problem-solving and accountability in learning.

PO13: Community Engagement and Service
Low direct connection to community engagement.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics (2024 Pattern)

Name of the Programme : B.Sc. Mathematics
Program Code : USMT
Class : F.Y.B.Sc.
Semester : II
Course Type : Practical
Course Name : Geometry and Differential Calculus Practical with Geogebra
Course Code : MAT-152-GEN
No. of Teaching Hours : 60
No. of Credits : 2

Course Objectives:

1. Develop proficiency in using GeoGebra to explore the locus of points and analyze the effects of changing coordinate axes.
2. Gain the ability to work with and graphically interpret the general equation of the second degree using GeoGebra.
3. Learn to identify the center of conic sections and reduce their equations to standard forms through GeoGebra.
4. Use GeoGebra to determine the equations of planes and calculate the length of perpendiculars from points to lines.
5. Develop skills in using GeoGebra to find the intersection of spheres and derive equations for circles and spheres through given points.
6. Utilize GeoGebra to visualize and comprehend the concepts of continuity and differentiability in functions.
7. Apply key calculus theorems, including the Mean Value Theorem, L'Hôpital's Rule, and Riemann integration, using GeoGebra to solve mathematical and practical problems.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Create and analyze loci of points and understand the impact of changing axes using GeoGebra.
CO2: Work with the general equation of the second degree and interpret its geometric representation using GeoGebra.
CO3: Determine the center of conic sections and reduce their equations to standard forms using GeoGebra.
CO4: Find the equations of planes under given conditions and calculate the length of the perpendicular from a point to a line using GeoGebra.
CO5: Determine the intersection of two spheres and derive the equation of circles or spheres passing through given points using GeoGebra.
CO6: Use GeoGebra to visualize and understand the concepts of continuity and differentiability of functions.
CO7: Apply the Mean Value Theorem, L'Hôpital's Rule, and Riemann integration using GeoGebra for solving calculus problems and real-world applications.

Topics and Learning Points

Teaching Hours

Geometry Practical using GeoGebra: **30**

1) Locus of Points and Change of Axes
2) General Equation of Second Degree
3) Centre of Conic and Reduction of Equation
4) Determination of Plane under Given Conditions
5) Length of Perpendicular from a Point to a Line
6) Intersection of Two Spheres and Equation of Circle/Sphere through a Given Cir

Differential Calculus Practical using GeoGebra: **30**

7) Continuity
8) Derivative
9) Mean Value Theorem
10) L'Hôpital's Rule
11) Riemann Integration
12) Applications of Derivative

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem II) **Subject:** Mathematics
Course: Geometry and Differential Calculus Practical with Geogebra
Course Code: MAT-152-GEN
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	3	3	3	3	3
PO2	3	3	3	3	3	2	3
PO3	1	1	1	1	1	1	1
PO4	3	3	3	3	3	3	3
PO5	3	3	3	3	3	3	3
PO6	2	2	2	2	2	2	2
PO7	2	2	2	2	2	2	2
PO8	2	2	2	2	2	2	2
PO9	3	3	3	3	3	3	3
PO10	1	1	1	1	1	1	1
PO11	1	1	1	1	1	1	1
PO12	2	2	2	2	2	2	2
PO13	1	1	1	1	1	1	1

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding
Students gain a deep understanding of geometric concepts and their applications.
PO2: Practical, Professional and Procedural Knowledge
Use of GeoGebra enhances practical knowledge in geometry and calculus applications.
PO3: Entrepreneurial Mindset and Knowledge
Limited relation as the focus is primarily on mathematical understanding rather than entrepreneurship.
PO4: Specialized Skills and Competencies
Development of specialized skills in geometry and calculus through the use of GeoGebra.
PO5: Capacity for Application, Problem-Solving and Analytical Reasoning
Students apply analytical reasoning to solve problems related to geometric figures and calculus.
PO6: Communication Skills and Collaboration
Use of GeoGebra may enhance communication of mathematical concepts but collaborative aspects are moderate.
PO7: Research-related Skills
Encourages inquiry-based learning and exploration in geometry and calculus topics.
PO8: Learning How to Learn Skills
Engaging with software like GeoGebra promotes self-directed learning.
PO9: Digital and Technological Skills
Proficiency in using GeoGebra directly enhances digital skills in mathematics.
PO10: Multicultural Competence, Inclusive Spirit and Empathy
Minimal relation as the focus is on mathematical skills rather than multicultural aspects.
PO11: Value Inculcation and Environmental Awareness

Limited relation to values and environmental awareness from a mathematical perspective.

PO12: Autonomy, Responsibility and Accountability

Students take responsibility for their learning and application of mathematical concepts.

PO13: Community Engagement and Service

Limited relation as the course focuses on academic skills rather than community service.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics (2024 Pattern)

Name of the Programme : B.Sc. Mathematics
Program Code : USMT
Class : F.Y.B.Sc.
Semester : II
Course Type : Open Elective (OE)
Course Name : Applied Mathematics
Course Code : MAT-153-OE
No. of Teaching Hours : 60
No. of Credits : 2

Course Objectives:

1. Develop analytical and problem-solving skills through the exploration and analysis of patterns in sequences and series.
2. Enhance number sense and critical thinking by engaging in activities and games that involve playing with numbers.
3. Develop spatial visualization and geometrical reasoning skills through hands-on construction and manipulation of geometric figures.
4. Understand and apply financial mathematics concepts, including interest, investments, and budgeting, in real-life scenarios.
5. Gain a clear understanding of sets, relations, and functions, and their role in mathematical analysis and problem-solving.
6. Develop a conceptual understanding of mathematical induction and apply it to prove mathematical statements.
7. Enhance problem-solving strategies and develop mathematical thinking skills through solving a variety of mathematical problems.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Analyze and recognize patterns in sequences and series, and apply them in solving mathematical problems and real-world scenarios.
CO2: Demonstrate an enhanced understanding of number properties and relationships through engaging in activities and games involving playing with numbers.
CO3: Construct and manipulate geometric figures accurately, demonstrating spatial visualization and reasoning abilities.
CO4: Apply financial mathematics principles to make informed financial decisions and solve problems related to personal finance.
CO5: Analyze probability scenarios and calculate probabilities, making informed decisions based on mathematical reasoning.
CO6: Apply the concepts of sets, relations, and functions in analyzing mathematical problems and real-world situations.
CO7: Students will be able to employ problem-solving strategies and mathematical thinking skills to solve a wide range of mathematical problems.

Topics and Learning Points

Teaching Hours

Theory: Introduction **12**

- Integers
- Geometrical shapes
- Cartesian coordinate system
- Financial mathematics

Practicals: **48**

1. Exploring Patterns: Analyzing sequences and series
2. Playing with numbers
3. Geometry in action: Constructing and manipulating geometric figures
4. Algebraic expressions and equations
5. Financial Mathematics
6. Problems on probability
7. What is Set?
8. What is Relation?
9. What is Function?
10. Mathematical induction
11. Problem solving strategies
12. Mathematical Modelling: Applying Mathematics to real world problems

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem II) **Subject:** Mathematics
Course: Applied Mathematics **Course Code:** MAT-153-OE
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	3	3	3	3	3
PO2	1	1	1	3	1	1	3
PO3	1	2	1	3	2	1	2
PO4	3	3	3	3	3	3	3
PO5	3	3	3	3	3	3	3
PO6	1	2	1	1	2	1	1
PO7	2	2	2	2	2	2	3
PO8	3	3	3	3	3	3	3
PO9	1	1	1	2	1	1	1
PO10	1	2	1	1	2	1	1
PO11	1	1	1	2	2	1	1
PO12	1	1	1	2	1	1	2
PO13	1	2	1	2	1	1	1

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding
All COs contribute to a broad understanding of mathematical concepts.
PO2: Practical, Professional and Procedural Knowledge
CO4 and CO7 apply practical knowledge directly, while others partially.
PO3: Entrepreneurial Mindset and Knowledge
CO4 encourages financial decision-making, while CO2, CO5, and CO7 help develop problem-solving skills.
PO4: Specialized Skills and Competencies
Analytical, spatial, and reasoning abilities are developed through most Cos.
PO5: Capacity for Application, Problem-Solving and Analytical Reasoning
Strong problem-solving and reasoning skills are developed across all COs.
PO6: Communication Skills and Collaboration
CO2 and CO5 develop communication and collaborative skills through activities and scenarios.
PO7: Research-related Skills
CO7 directly encourages research and critical thinking, while others involve analytical skills.
PO8: Learning How to Learn Skills
All COs contribute to learning strategies and self-improvement.
PO9: Digital and Technological Skills
CO4 has a strong connection through financial tools, while others indirectly relate to tech usage.
PO10: Multicultural Competence, Inclusive Spirit and Empathy
CO2 and CO5 involve collaboration, fostering an inclusive mindset.
PO11: Value Inculcation and Environmental Awareness
CO4 and CO5 promote responsibility and decision-making awareness.

PO12: Autonomy, Responsibility and Accountability
CO4 and CO7 emphasize responsibility in decision-making and problem-solving.
PO13: Community Engagement and Service
CO2 and CO4 have moderate links through collaboration and finance-based community activities.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Mathematics (2024 Pattern)

Name of the Programme : B.Sc. Mathematics
Program Code : USMT
Class : F.Y.B.Sc.
Semester : II
Course Type : Skill Enhancement Course (SEC)
Course Name : Maxima Software
Course Code : MAT-154-SEC
No. of Teaching Hours : 60
No. of Credits : 2

Course Objectives:

1. Gain proficiency in expanding and simplifying polynomial expressions using Maxima for efficient algebraic manipulation.
2. Develop skills to factorize both simple and complex quadratic equations using Maxima, enhancing algebraic problem-solving techniques.
3. Learn to calculate first and higher-order derivatives of functions using Maxima, applying differentiation in various mathematical contexts.
4. Understand and apply integral calculus by evaluating indefinite and definite integrals of basic functions using Maxima.
5. Master the computation of limits of functions as they approach specific values or infinity using Maxima, reinforcing understanding of limits.
6. Acquire the ability to solve simple first-order differential equations analytically and with initial conditions using Maxima.
7. Develop competency in using Maxima for various mathematical operations, enhancing computational problem-solving abilities and mathematical understanding.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Expand and simplify polynomial expressions using Maxima, demonstrating a clear understanding of polynomial manipulation.
CO2: Factorize both simple and complex quadratic equations using Maxima, showcasing proficiency in algebraic techniques.
CO3: Calculate the first and higher-order derivatives of functions using Maxima, applying differentiation techniques accurately.
CO4: Evaluate indefinite and definite integrals of basic functions using Maxima, understanding integral calculus applications.
CO5: Compute the limits of functions as they approach specific values or infinity using Maxima, reinforcing concepts of limits and continuity.
CO6: Solve simple first-order differential equations analytically and with initial conditions using Maxima, applying differential equation-solving methods.
CO7: Utilize Maxima for a range of mathematical operations, enhancing problem-solving skills and understanding of mathematical concepts through computational tools.

Topics and Learning Points

	Teaching Hours
Theory: Maxima software	**12**

1) Polynomials
2) Quadratic equations
3) Limit, derivatives and integrations
4) First order differential equations

Practicals:	**48**

1. Expand and Simplify a Polynomial Expression in Maxima
2. Combine Expansion and Simplification of Polynomial Expressions in Maxima.
3. Factorize a Simple Quadratic Equation in Maxima.
4. Factorize a Complex Quadratic Equation in Maxima.
5. Calculate the First Derivative of a Function in Maxima.
6. Calculate Higher-Order Derivatives of a Function in Maxima.
7. Evaluate Indefinite Integrals of Basic Functions in Maxima.
8. Evaluate Definite Integrals with Given Limits in Maxima.
9. Compute the Limit of a Function as it Approaches a Specific Value in Maxima.
10. Compute the Limit of a Function as it Approaches Infinity in Maxima.
11. Solve a Simple First-Order Differential Equation Analytically in Maxima.
12. Solve a First-Order Differential Equation with Initial Conditions in Maxima.

Reference Books:

1. Edwin L. Woollett, *Maxima by example: A step by step introduction to computer algebra using Maxima*

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B.Sc. (Sem II) **Subject:** Mathematics
Course: Maxima Software **Course Code:** MAT-154-SEC
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO1	3	3	3	3	3	3	3
PO2	3	3	3	3	3	3	3
PO3	1	1	1	1	1	1	1
PO4	3	3	3	3	3	3	3
PO5	2	2	3	3	3	3	3
PO6	1	1	1	1	1	2	2
PO7	2	2	2	2	2	2	2
PO8	2	2	2	2	2	2	2
PO9	3	3	3	3	3	3	3
PO10	1	1	1	1	1	1	1
PO11	1	1	1	1	1	1	1
PO12	2	2	2	2	2	2	2
PO13	1	1	1	1	1	1	1

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding
All COs contribute directly to comprehensive knowledge and understanding of mathematical concepts and techniques through Maxima.
PO2: Practical, Professional and Procedural Knowledge
Strong practical and procedural knowledge is reinforced by using Maxima for algebra, calculus, and differential equations.
PO3: Entrepreneurial Mindset and Knowledge
Low relation as the course does not focus on entrepreneurial skills or mindset development.
PO4: Specialized Skills and Competencies
High emphasis on developing specialized skills in algebraic manipulation, calculus, and differential equations using Maxima.
PO5: Capacity for Application, Problem-Solving and Analytical Reasoning
COs involve problem-solving and analytical reasoning, especially in calculus and differential equations.
PO6: Communication Skills and Collaboration
CO6 and CO7 slightly contribute to communication and collaboration in problem-solving and working in computational environments.
PO7: Research-related Skills
Moderate emphasis on research-related skills through computational problem-solving and analysis using Maxima.
PO8: Learning How to Learn Skills
Learning how to use Maxima tools is a continuous learning process, applicable across the COs.
PO9: Digital and Technological Skills

Maxima is a digital tool, making COs strongly related to the development of digital and technological skills.

PO10: Multicultural Competence, Inclusive Spirit and Empathy

Low relation, as there is minimal focus on multicultural competence or empathy.

PO11: Value Inculcation and Environmental Awareness

Low relation, as the COs are not focused on environmental awareness or value inculcation.

PO12: Autonomy, Responsibility and Accountability

The COs foster autonomy and accountability in problem-solving using Maxima, but the focus is moderate.

PO13: Community Engagement and Service

Low relation to community engagement and service since the course does not focus on these aspects directly.