

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune 5

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Framework of Syllabus

For

B. Sc. (Mathematics)

Choice Based Credit System (CBCS) Syllabus Under National
Education Policy (NEP)

To be implemented from Academic Year 2024-2025

Level:- 4.5 (First Year)**Sem:I**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	ESE	Total
Subject 1 T(2)+ (T/P) (2) or T(4)	24ScMatU1101	Algebra	2		2		20	30	50
	24ScMatU1102	Lab Course on 24ScMatU1101		2		4	20	30	50
Subject 2 T(2)+ (T/P) (2) or T(4)	24Sc***U1201	<<Subject 2 Theory>>	2		2		20	30	50
	24Sc***U1202	<<Subject 2 Practical>>		2		4	20	30	50
Subject 3 T(2)+ (T/P) (2) or T(4)	24Sc***U1301	<<Subject 3 Theory>>	2		2		20	30	50
	24Sc***U1302	<<Subject 3 Practical>>		2		4	20	30	50
IKS T(2)	24CpCopU1901	Generic IKS	2		2		20	30	50
GE/OE (T/P) (2)	24ScMatU1401	Fundamentals of Mathematics	2		2		20	30	50
SEC (P) (2)	24ScMatU1601	Lab Course on Analytical Geometry		2		4	20	30	50
AEC T(2)	24CpCopU1701 / 24CpCopU1702	MIL-I (Hindi) / MIL-I (Marathi)	2		2		20	30	50
VECT (2)	24CpCopU1801	Environmental Science	2		2		20	30	50
Total			14	08	14	16			550

Level:- 4.5 (First Year)**Sem:II**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	ESE	Total
Subject 1 T(2)+ T/P(2) or T(4)	24ScMatU2101	Calculus	2		2		20	30	50
	24ScMatU2102	Lab Course on 24ScMatU2101		2		4	20	30	50
Subject 2 T(2)+ P(2)	24Sc***U2201	<<Subject 2 Theory>>	2		2		20	30	50
	24Sc***U2302	<<Subject 2 Practical>>		2		4	20	30	50
Subject 3 T(2)+ P(2)	24Sc***U2301	<<Subject 3 Theory>>	2		2		20	30	50
	24Sc***U2302	<<Subject 3 Practical>>		2		4	20	30	50
GE/OE (T/P)(2)	24ScMatU2401	Business Mathematics	2		2		20	30	50
SEC P(2)	24ScMatU2601	Lab course on Logic		2		4	20	30	50
AEC T(2)	24CpCopU2703	English Communication Skills I	2		2		20	30	50
VEC T(2)	24CpCopU2801	Democracy, Election and Governance	2		2		20	30	50
CC(2)	24CpCopU200 1 / 24CpCopU201 1 / 24CpCopU202 1 / 24CpCopU203 1 / 24CpCopU204 1 / 24CpCopU205 1 / 24CpCopU206 1 / 24CpCopU207 1	Physical Education / Cultural Activities / NSS / NCC / Fine Arts / Applied Arts / Visual Arts / Performing Arts	2		2		20	30	50
Total			14	08	14	16			550

Level:- 5.0 (Second Year) Sem:III

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2 or 4), (T/P)(2)	24ScMatU3101	Multivariate Calculus	4		4		20	30	50
	24ScMatU3102	Lab Course on 24ScMatU3101		2		4	20	30	50
VSC P(2)	24ScMatU3501	Lab Course on Discrete Mathematics		2		4	20	30	50
IKS (T/P)(2)	24ScMatU3901	Ancient Indian Mathematics	2		2		20	30	50
FP P(2)	24ScMatU3002	Field Project I		2		4	20	30	50
Minor (T/P)(2+2 or 4)	24ScMatU3301	Numerical Methods And Its Applications	2		2		20	30	50
	24ScMatU3302	Lab Course On 24ScMatU3301		2		4	20	30	50
GE/OE (T/P) (2)	24ScMatU3401	Financial Mathematics	2		2		20	30	50
AEC T(2)	24CpCopU3703	English Communication Skills II	2		2		20	30	50
CC T(2)	24CpCopU3001	Online Course on Yoga	2		2		20	30	50
Total			14	08	14	16			550

Level:- 5.0 (Second Year) Sem:IV

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2 or 4), (T/P)(2)	24ScMatU4101	Linear Algebra	4		4		20	30	50
	24ScMatU4102	Lab Course on 24ScMatU4101		2		4	20	30	50
VSC P(2)	24ScMatU4501	Lab Course on Computational Geometry		2		4	20	30	50
CEP P(2)	24ScCopU4003	Community Engagement Project		2		4	20	30	50
Minor (T/P)(2+2 or 4)	24ScMatU4301	Linear Algebra	2		2		20	30	50
	24ScMatU4302	Lab Course on 24ScMatU4301		2		4	20	30	50
GE/OE (T/P) (2)	24ScMatU4401	Basics of Operations Research	2		2		20	30	50
SEC P(2)	24ScMatU4601	Lab Course on SciLab		2		4	20	30	50
AEC T(2)	24CpCopU4701 / 24CpCopU4702	MIL-II (Hindi) / MIL-II (Marathi)	2		2		20	30	50
CC T(2)	24CpCopU4001	Health and Wellness	2		2		20	30	50
Total			12	10	12	20			550

Level:- 5.5 (Third Year) Sem:-V

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2+2+2 or 4 + 2+2 or 4 + 4) P(2+2 or 4)	24ScMatU5101	Real Analysis	4		4		40	60	100
	24ScMatU5102	Abstract Algebra	4		4		40	60	100
	24ScMatU5103	Vector Calculus	2		2		20	30	50
	24ScMatU5104	Lab Course on 24ScMatU5101 & 24ScMatU5102		2		4	20	30	50
Major Elective (T/P) (2+2 or 4)	24ScMatU5201	Operations Research	2		2		20	30	50
	24ScMatU5202	Lab Course on 24ScMatU5201		2		4	20	30	50
	24ScMatU5203	Metric Spaces	2		2		20	30	50
	24ScMatU5204	Lab Course on 24ScMatU5203		2		4	20	30	50
VSC P(2)	24ScMatU5501	Lab Course on Computer Oriented Numerical Methods		2		4	20	30	50
FP P(2)	24ScMatU5001	Field Project II		2		4	20	30	50
Minor (T/P) (2)	24ScMatU5302	Lab Course on Ordinary Differential Equations		2		4	20	30	50
Total			12	10	12	20			550

Level:- 5.5 (Third Year) Sem:-VI

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2+2+2 or 4+2+2 or 4+4) P(2+2 or 4)	24ScMatU610 1	Complex Analysis	4		4		40	60	100
	24ScMatU610 2	Differential Equations	4		4		40	60	100
	24ScMatU610 3	Number Theory	2		2		20	30	50
	24ScMatU610 4	Lab Course on 23ScMat6101 & 23ScMat6102		2		4	20	30	50
Major Elective (T/P) (2+2 or 4)	24ScMatU620 1	Graph Theory	2		2		20	30	50
	24ScMatU620 2	Lab Course on 24ScMatU6201		2		4	20	30	50
	24ScMatU620 3	Laplace Transforms and Fourier Series	2		2		20	30	50
	24ScMatU620 4	Lab Course on 24ScMatU6203		2		4	20	30	50
VSC P(2)	24ScMatU650 1	Lab Course on Python		2		4	20	30	50
OJT P(2)	24ScMatU600 4	On Job Training		4		8	40	60	100
Total			12	10	12	20			550

Semester 1 (First Year) Level 4.5

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First Year of B.Sc.
(2024 Course under NEP 2020)

Course Code: 24ScMatU1101

Course Name: Algebra

Teaching Scheme: TH: 2 Hours/Week

Examination Scheme: CIA: 20 Marks

Credits: 2

End-Sem : 30 Marks

Prerequisite Courses:

- Number system
- Basic theory of matrices.

Course Objectives:

- To study number theoretic properties using Division Algorithm for integers, Euler's theorem and Fermat's theorem.
- To study congruence relation on the set of integers.
- To study the system of linear equations.

Course Outcomes: On completion of the course, student will be able to understand

- G.C.D., L.C.M. and properties of divisibility in integers and polynomials
- Consistency and methods of solving systems of linear equations.

Course Contents:

Unit 1	Integers	20 lectures
	• Well Ordering Property for natural numbers • Divisibility in integers, • Division Algorithm • G.C.D. and L.C.M of two integers • Euclidean Algorithm • Prime and composite integers, Euclid's Lemma, Unique Factorization Theorem for integers • Congruence relation and its properties • Euler's theorem, Fermat's theorem and Wilson's theorem	
Unit 2	Linear Equations	10 lectures
	• Homogeneous and non homogeneous system of linear equations • Matrix Algebra : Determinants, Rank and Equivalence of matrices. • Row echelon form, Reduced row echelon form, Consistency of a system of linear equations • Solving systems of linear equations using Gauss Elimination and Gauss Jordan method, Cramer's rule.	

Reference Books :

1. Discrete Mathematical Structures by Bernard Kolman, Robert C. Busby, Sharon Cutler Ross and Nadeem-ur-Rehman, Pearson Education, Fifth Edition, 2004.
2. Elementary Number Theory by David Burton, Tata McGraw Hill (Walter Rudin Series), Indian Edition, 1980.
3. Matrices by Shanti Narayan, S. Chand and Co., New Delhi, 1957.
4. Complex Variables and Applications by Ruel. V. Churchill, McGraw Hill Company (8th Edition), 2009.

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Course Code: 24ScMatU1102**Course Name: Lab Course on 24ScMat1101****Teaching Scheme: PR: 4 Hours/Week****Credit: 2****Examination Scheme: CIA: 20 Marks****End-Sem : 30 Marks****Prerequisite Courses:** Set Theory, Algebra and Complex numbers.**Course Objective:** The student should be able to solve problems depending on the contents in Set

Theory, Algebra and Complex numbers.

Course Outcomes: On completion of the course, student will be able to

- Understand the theoretical concepts in Algebra using Maxima software.
- Apply this knowledge in various courses of Science and Technology.

Course Contents:**Practical 1 : Sets and Relations****Practical 2 : Bijective Functions****Practical 3 : Images under functions****Practical 4 : Graphs of functions****Practical 5 : Division Algorithm****Practical 6 : GCD and LCM****Practical 7 : Congruences****Practical 8 : Euler's and Fermat's Theorem****Practical 9 : GCD of polynomials****Practical 10 : Factorisation of polynomials****Practical 11 : Consistency of system of equations****Practical 12 : Gauss elimination method****Practical 13 : Gauss Jordan method****Practical 14 : Complex numbers****Practical 15 : De-Moivre's theorem**

Reference Books :

1. Discrete Mathematical Structures by Bernard Kolman, Robert C. Busby, Sharon Cutler Ross and Nadeem-ur-Rehman, Pearson Education, Fifth Edition, 2004.
2. Elementary Number Theory by David Burton, Tata McGraw Hill (Walter Rudin Series), Indian Edition, 1980.
3. Matrices by Shanti Narayan, S. Chand and Co., New Delhi, 1957.
4. Complex Variables and Applications by Ruel. V. Churchill, McGraw Hill Company (8th Edition), 2009.
5. <https://maxima.sourceforge.io/docs/maximabook/maximabook-19-Sept-2004.pdf>

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First Year of B.Sc.
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Course Code: 24ScMatU1401 Course Name: Fundamentals of Mathematics
Teaching Scheme: TH: 2 Hours/Week Credits: 2
Examination Scheme: CIA: 20 Marks End-Sem: 30 Marks

Prerequisite Course: Basic knowledge of arithmetic in Real numbers

Course Objectives:

- To Study functions and their graphs
- To Study determinants and matrices and System of equations.
- To Study Arithmetic and Geometric progressions.
- To Study the concept of Limits, Continuity, Differentiability and Integration.

Course Outcomes: On completion of the course, student will be able to

- To apply the knowledge of graphs of functions in other courses.
- To apply the knowledge of differentiation and integration in other courses.

Course Contents :

Unit 1	Basic Algebra	15 lectures
	• Number Systems, Sets and Relations. • Functions, Graphs of functions • Polynomials • Determinants and Matrices • System of Equations • Arithmetic and Geometric progression	
Unit 2	Basic Calculus	15 lectures
	• Basics of Limits and Continuity • Elementary Differentiation • Integration of standard functions • Applications of Differentiation and Integration.	

Reference Books:

1. Mathematical Analysis by S. C. Malik and Savita Arora, New Age International Pvt. Ltd. (Second edition), 1992.
2. Matrices by Shanti Narayan, S. Chand and Co., New Delhi, 1957.
3. Business Mathematics and Statistics by R. K. Ghosh and S. Saha, New Central Book Agency Pvt. Ltd, Ninth Revised Edition, 2002.

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First Year of B.Sc.
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Course Code: 24ScMatU1601

Course Name: Lab Course on Analytical Geometry

Teaching Scheme: PR: 4 Hours/Week

Credits: 2

Examination Scheme: CIA: 20 Marks

End-Sem : 30 Marks

Prerequisite:

- Basic knowledge of Cartesian coordinate systems up to three dimensions.
- Basic knowledge of line, plane, sphere, cylinder and cone.

Course Objectives: The aim of this course is

- To study geometrical objects like line, plane, sphere, cylinder and cone in three-dimensional space.
- To study properties of geometrical objects like line, plane, sphere, cylinder and cone.
- To study equations of geometrical objects like line, plane, sphere, cylinder and cone.

Course Outcomes: On completion of the course, student will able to

- Find equations of geometrical objects like line, plane, sphere, cylinder and cone.

- Visualize and understand geometry of three dimensional objects using Geogebra.

Course Contents :

Practical 1 : Direction ratios and direction cosines.

Practical 2 : Equations of a line

Practical 3 : Angle between two lines

Practical 4 : Distance of a point from a line

Practical 5 : Coplanar lines

Practical 6 : Skew lines

Practical 7 : Equations of a plane

Practical 8 : Angle between two planes

Practical 9 : Lines and planes

Practical 10 : System of planes

Practical 11 : Equations of a sphere

Practical 12: Tangent plane to sphere

Practical 13: Equations of a cylinder

Practical 14: Equations of a cone

Practical 15: Conics

Reference Books:

1. Analytical Solid Geometry by Shanti Narayan and P. K. Mittal, S. Chand and Company Ltd, New Delhi, 1998 (Reprint 2018).
2. A Text Book of Analytical Geometry of Three Dimensions by P. K. Jain and Khalil Ahmad, Wiley Eastern Ltd. 1999.
3. Analytical Geometry of two and three dimensions and Vector Analysis by R. M. Khan, New central book agency (P) Ltd, Kolkata, Fourth revised edition, 2002.
4. Analytical Geometry of two and three dimensions by D. Chatterjee, Narosa Publishing House Pvt. Ltd., 2009.
5. <https://wiki.geogebra.org/en/Manual> (03/06/2023).

Semester 2 (First Year) Level 4.5

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First Year B.Sc.

(2024 Course under NEP 2020)

Course Code: 24ScMatU2101

Teaching Scheme: TH: 2 Hours/Week

Examination Scheme: CIA: 20 Marks

Course Name: Calculus

Credits: 2

End-Sem : 30 Marks

Prerequisite Courses:

- Basic knowledge of real numbers, Sets and Intervals
- Basic knowledge of limit, continuity, derivative and integration of a real valued function of a real variable.

Course Objectives:

- The aim of this course is to understand the notion of limit, continuity and differentiability of real valued functions of real variables.
- To study the derivative and integration, and their geometrical interpretations.

Course Outcomes: Student will be able to

- Understand basic properties of real numbers.
- Understand the concept of limit, continuity, derivative and integration.

Course Contents :

Unit 1	Limit and Continuity	10 lectures
	• Cluster point, Definition of limit of a real valued function • Basic properties of limits • Definition of continuous function at a point, Types of discontinuity, Composition of continuous functions. • Continuous functions on an intervals • Properties of continuous functions • Location of roots and Intermediate value theorem	
Unit 2	Differentiation	12 lectures
	• Definition of a derivative of real valued function at a point, Derivative and its geometric interpretation • Relation between differentiability and continuity • Differentiability over an interval • Algebra of differentiable functions • Chain rule for derivatives, Derivative of inverse functions	
Unit 3	Integration	8 lectures
	• Integration and its geometric interpretation, • Integration of rational functions using partial fractions • Integration of irrational functions • Reduction formulae	

Reference Books :

1. Mathematical Analysis by S. C. Malik and Savita Arora, New Age International Pvt. Ltd. (Second edition), 1992.
2. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, John Wiley & Sons (3rd Edition), 2000.
3. Calculus Volume I – One Variable Calculus with Introduction to Linear Algebra by Tom M. Apostol, John Wiley and Sons (2nd Edition), 2002.
4. Differential Calculus by Shanti Narayan and Mittal P. K., S. Chand and Co. (11th Edition), New Delhi, 2005.

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First Year of B.Sc
(2024 Course under NEP 2020)

Course Code: 24ScMatU2102

Course Name: Lab Course on 24ScMat2101

Teaching Scheme: PR: 4 Hours/Week

Examination Scheme: CIA: 20 Marks

Credits: 2

End-Sem: 30 Marks

Prerequisite Courses: Calculus and Maxima.

Course Objectives: The student should be able to solve problems depending on contents in Limits, Continuity, Derivative and Integration.

Course Outcomes: On completion of the course, student will be able to

- Understand the theoretical concepts in Calculus.
- Apply this knowledge in various courses of Science and Technology.
- Understand the visualization of the concepts using Maxima software.

Course Contents :

Practical 1: Real numbers

Practical 2: Limit of functions

Practical 3: Continuity of real valued functions

Practical 4: Differentiability of functions

Practical 5: Derivative of inverse functions

Practical 6: Intermediate value theorem

Practical 7: Extreme values of functions

Practical 8: Rolle's theorem

Practical 9: Lagrange's mean value theorem

Practical 10: Cauchy mean value theorem

Practical 11: Indeterminate forms

Practical 12: Successive differentiations

Practical 13: Taylor's theorem

Practical 14: Integration of functions

Practical 15: Reduction formulae

Reference Books :

1. Mathematical Analysis by S. C. Malik and Savita Arora, New Age International Pvt. Ltd. Second Edition, 1992 (Reprint 2005).
2. Calculus Volume I – One Variable Calculus with Introduction to Linear Algebra by Tom M. Apostol, John Wiley and Sons (2nd Edition), 2002.
3. Differential Calculus by Shanti Narayan and Mittal P. K., S. Chand and Co.(11th Edition), New Delhi, 2005.
4. The Maxima Book by Paulo Ney de Souza, Richard J. Fateman, Joel Moses and Cliff Yapp, e-book, 2004.
<https://maxima.sourceforge.io/docs/maximabook/maximabook-19-Sept-2004.pdf>
(03/06/2023)

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First Year of B.Sc.
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Course Code: 24ScMatU2401

Course Name: Business Mathematics

Teaching Scheme: TH: 2 Hours/Week

Examination Scheme: CIA: 20 Marks

Credits: 2

End-Sem : 30 Marks

Pre-requisites:

- Basic knowledge of number systems.
- Basic knowledge of addition, subtraction, multiplication, division of numbers as well as fractions.

Course Objectives:

- To understand the concept of simple interest, compound interest and the concept of equated monthly installments.
- To understand the concept of shares and to calculate Dividend.

Course Outcomes:

- This course will help the students for preparation for banking examinations, actuarial sciences etc.
- Students can calculate various types of interests for different periods.
- Students can understand the actual working of the share market.

Course Contents :

Unit 1	Preliminaries	10 lecture s
	● Ratio and Proportion ● Percentage ● Profit and Loss ● Commission And Brokerage	
Unit 2	Interest and Shares	12 lecture s
	● Simple Interest and Compound Interest ● Nominal and effective rate of interest ● Annuity, perpetuity ● Equated Monthly Installments (EMI)	
Unit 3	Shares and Dividends	8 lecture s
	● Concept of Shares, face value, market value, Net Asset Value ● Equity Shares and Preference shares ● Dividend	

Reference Books :

1. Practical Business Mathematics by S.A.Bari, New Literature Publishing Company, 1977.
2. Business Mathematics by V. K. Kapoor, Sultan Chand And Sons, 1982.
3. Business Mathematics by D. C. Sancheti and V. K. Kapoor, Sultan Chand and Sons, 1993.
4. Business Mathematics and Statistics by R. K. Ghosh and S. Saha, New Central Book Agency Pvt. Ltd, Ninth Revised Edition, 2002.

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First Year of B.Sc.
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Course Code: 24ScMatU2601

Course Name: Lab Course on Logic

Teaching Scheme: PR: 4 Hours/Week

Examination Scheme: CIA: 20 Marks

Credits: 2

End-Sem : 30 Marks

Prerequisites: Basic knowledge of propositions, Truth values of statements and truth tables.

Course Objectives: The aim of this course is

- To check equivalence of statement patterns.
- To check the statements for tautology and contradiction.
- To study methods of proofs of various mathematical statements.
- To study Boolean algebra.
- To understand Paradoxes and conjectures in mathematics.

Course Outcomes: On completion of the course, student will able to understand

- The concept of logic in other Mathematical courses.
- The mathematics of Boolean Algebra and its applications.

Course Contents:

Practical 1 : Propositional Logic

Practical 2 : Truth Tables

Practical 3 : Propositional equivalences

Practical 4 : Indirect method

Practical 5 : Quantifiers

Practical 6 : Nested Quantifiers

Practical 7 : Rules of Inference

Practical 8 : Validity of arguments

Practical 9 : Basic Induction

Practical 10 : Strong Induction

Practical 11 : Method of Contradiction and Contraposition

Practical 12 : Paradoxes

Practical 13 : Boolean Algebra

Practical 14 : CNF and DNF

Practical 15 : Conjectures

Reference Books:

1. Discrete Mathematics and Its Applications by Kenneth H Rosen, McGraw Hill, Seventh Edition, 2011.
2. Symbolic Logic by I.M. Copi, Prentice Hall of India, Fifth Edition, 1995.
3. Discrete Mathematical Structures by Bernard Kolman, Robert C. Busby, Sharon Cutler Ross and Nadeem-ur-Rehman, Pearson Education, Fifth Edition, 2004.
4. Applied Combinatorics by Alan Tucker, Fourth Edition, 2001.