

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)

(Based on NEP 2020 framework)

(To be implemented from the Academic Year 2023-24)

Semester 1 (First Year) Level 4.5

Course Type	Course Code	Course	Course / Paper Title	Hours / Week	Credit	CI A	ES E	Total
Major Mandatory (4 + 2)	23ScMatU1101	Major Paper 1 (Theory) Section 1	Algebra	2	4	40	60	100
		Major Paper 1 (Theory) Section 2		2				
	23ScMatU1102	Major Paper 2 (Practical)	Mathematics Practical I (Based On Algebra)	4	2	20	30	50
Major Electives		-						
Minor		-						
OE (2 + 2)	23ScMatU1401		Fundamentals of Mathematics	2	4	40	60	100
	23CoCop1402		Democracy, Election and Governance	2				
VSC (2)	23ScMatU1501	Major Specific Practical I	Logic	4	2	20	30	50
SEC (2)	23ScMatU1601	Skill Paper 1 (Practical)	Analytical Geometry	4	2	20	30	50
AEC(2),	23CpCopU1701 / 23CpCopU1702	MIL	MIL-I (Hindi) / MIL-I (Marathi)	2	2	20	30	50
VEC (2)	23CoCop1801	EVS Theory	Environment Science I	2	2	20	30	50
IKS (2)	23ScMatU1901	Major Specific Theory	Ancient Mathematics	2	2	20	30	50
CC (2)	23CoCop1001	CC-I Course	Online Course Based on Yoga	2	2	20	30	50
Total				28	22	220	330	550

Semester 2 (First Year) Level 4.5

Course Type	Course Code	Course	Course / Paper Title	Hours / Week	Credit	CI A	ES E	Total
Major Mandatory (4 + 2)	23ScMatU2101	Major Paper 3 (Theory) Section 1	Calculus	2	4	40	60	100
		Major Paper 3 (Theory) Section 2		2				
	23ScMatU2102	Major Paper 4 (Practical)	Mathematics Practical II (Based On Calculus)	4	2	20	30	50
Major Electives		-						
Minor	23ScMatU2201	Minor Paper I (Practical)	Practicals On Mathematical Logic	4	2	20	30	50
OE (2 + 2)	23ScMatU2401		Business Mathematics	2	4	40	60	100
	23CoCop2402		Fundamentals of Music	2				
VSC (2)	23ScMatU2501	Major Specific Practical II	Discrete Mathematics	4	2	20	30	50
SEC (2)	23ScMatU2601	Skill Paper II (Practical)	Computational Geometry	4	2	20	30	50
AEC(2),	23CoCop2703	English Theory	English Communication Skills I	2	2	20	30	50
VEC (2)	23CoCop2801	EVS Theory	Environment Science II	2	2	20	30	50
IKS (2)								
CC (2)	23CoCop2001	CC-II Course	Physical Education / Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts Course	2	2	20	30	50
Total				30	22	220	330	550

Semester 3 (Second Year) Level 5

Course Type	Course Code	Course	Course / Paper Title	Hours / Week	Credit	CI A	ES E	Total
Major Mandatory (4 + 4)	23ScMatU3101	Major Core Paper 5 (Theory) Section 1	Multivariate Calculus	2	4	40	60	100
		Major Core Paper 5 (Theory) Section 2		2				
	23ScMatU3102	Major Paper 6 (Practical) on Section 1	Mathematics Practical III (Based On Multivariate Calculus)	4	4	40	60	100
		Major Paper 6 (Practical) on Section 2		4				
Major Electives		-						
Minor (4)	23ScMatU3301	Minor Paper II (Theory) Section I	Discrete Mathematics	2	4	40	60	100
		Minor Paper II (Practical) Section 2	Practicals On Discrete Mathematics	4				
OE (2)	23ScMatU3401		Financial Mathematics	2	2	20	30	50
VSC (2)	23ScMatU5101	Major Specific Practical III	Computer Oriented Numerical Methods	4	2	20	30	50
SEC (2)		--	--	--	--	--	--	--
AEC(2),	23CoCop3703	English Theory	English Communication Skills II	2	2	20	30	50
VEC (2)		--	--	--	--	--	--	--
IKS (2)		--	--	--	--	--	--	--
FP/CEP (2)	23ScMatU3002	FP –I	Field Project - I	4	2	20	30	50
CC(2)	23CoCop3001	CC III		2	2	20	30	50
Total				32	22	220	330	550

Semester 4 (Second Year) Level 5

Course Type	Course Code	Course	Course / Paper Title	Hours / Week	Credit	CI A	ES E	Total
Major Mandatory (4 + 4)	23ScMatU4101	Major Core Paper 7 (Theory) Section 1	Linear Algebra	2	4	40	60	100
		Major Core Paper 7 (Theory) Section 2		2				
	23ScMatU4102	Major Paper 8 (Practical) on Section 1	Mathematics Practical IV (Based On Linear Algebra)	4	4	40	60	100
		Major Paper 8 (Practical) on Section 2		4				
Major Electives		-						
Minor (4)	23ScMatU4301	Minor Paper III (Theory) Section 1	Elementary Calculus	2	4	40	60	100
		Minor Paper III (Practical) Section 2	Practicals On Elementary Calculus	4				
OE (2)	23ScMatU4401		Basics of Operations Research	2	2	20	30	50
VSC (2)		--	--	--	--	--	--	--
SEC (2)	23ScMatU4601	Skill Paper III (Practical)	Practicals On Vector Calculus	4	2	20	30	50
AEC(2),	23CoCop4701/ 23CoCop4702	MIL	MIL-II (Hindi) / MIL-II (Marathi)	2	2	20	30	50
VEC (2)		--	--	--	--	--	--	--
IKS (2)		--	--	--	--	--	--	--
FP / CEP(2)	23ScMatU4003	CEP –I	Community Engagement Project-I	4	2	20	30	50
CC(2)	23CoCop4001	CC-4		2	2	20	30	50
Total				32	22	220	330	550

Semester 5 (Third Year) Level 5.5

Course Type	Course Code	Course	Course / Paper Title	Hours / Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 4 + 2)	23ScMatU5101	Major Core Paper 9 (Theory) Section 1	Real Analysis	2	4	40	60	100
		Major Core Paper 9 (Theory) Section 2		2				
	23ScMatU5102	Major Paper 10 (Theory) Section 1	Abstract Algebra	2	4	40	60	100
		Major Paper 10 (Theory) Section 2		2				
	23ScMatU5103	Major Paper 11 (Practical)	Mathematics Practical V (Based On Real Analysis and Abstract Algebra)	4	2	20	30	50
Major Electives	23ScMatU5201	Elective I (Theory)	Operations Research	2	4	40	60	100
	23ScMatU5202	Elective I (Practical)	Mathematics Practical VI (Based On Operations Research)	4				
	23ScMatU5203	Elective II (Theory)	Metric Spaces	2	4	40	60	100
	23ScMatU5204	Elective II (Practical)	Mathematics Practical VI (Based On Metric Spaces)	4				
Minor (4)	23ScMatU5301	Minor Paper IV (Theory) Section 1	Ordinary Differential Equations	2	4	40	60	100
		Minor Paper IV (Practical) Section 2	Practicals On Ordinary Differential Equations	4				
OE (2)		--	--	--	--	--	--	--
VSC (2)	23ScMatU5501	Major Specific Practical IV	Practicals on Latex	4	2	20	30	50
SEC (2)		--	--	--	--	--	--	--
AEC(2),		--	--	--	--	--	--	--

VEC (2)		--	--	--	--	--	--	--
IKS (2)		--	--	--	--	--	--	--
FP / CEP(2)	23ScMatU5002	FP –II	Field Project - II	4	2	20	30	50
Total				38	22	220	330	550

Semester 6 (Third Year) Level 5.5

Course Type	Course Code	Course	Course / Paper Title	Hours / Week	Credit	CIA	ESE	Total
Major Mandatory (4 + 4 + 2)	23ScMatU6101	Major Core Paper 12 (Theory) Section 1	Complex Analysis	2	4	40	60	100
		Major Core Paper 12 (Theory) Section 2		2				
	23ScMatU6102	Major Paper 13 (Theory) Section 1	Differential Equations	2	4	40	60	100
		Major Paper 13 (Theory) Section 2		2				
	23ScMatU6103	Major Paper 14 (Practical)	Mathematics Practical VII (Based On Complex Analysis and Differential Equations)	4	2	20	30	50
Major Electives	23ScMatU6201	Elective III (Theory)	Number Theory	2	4	40	60	100
	23ScMatU6202	Elective III (Practical)	Mathematics Practical VIII (Based On Number Theory)	4				
	23ScMatU6203	Elective IV (Theory)	Laplace Transforms and Fourier Series	2	4	40	60	100
	23ScMatU6204	Elective IV (Practical)	Mathematics Practical VIII (Based On Laplace Transforms and Fourier Series)	4				

Minor (4)	23ScMatU6301	Minor Paper V (Theory) Section 1	Numerical Methods and its applications	2	4	40	60	100
		Minor Paper V (Practical) Section 2	Practicals On Numerical Methods and its applications	4				
OE (2)		--	--	--	--	--	--	--
VSC (2)		--	--	--	--	--	--	--
SEC (2)		--	--	--	--	--	--	--
AEC(2),		--	--	--	--	--	--	--
VEC (2)		--	--	--	--	--	--	--
IKS (2)		--	--	--	--	--	--	--
FP / CEP(2)		--	--	--	--	--	--	--
OJT(4)	23ScMatU6004	OJT	On Job Training	8	4	40	60	100
Total				38	22	220	330	550

OE : Open Elective

AEC: Ability Enhancement Course

VEC: value Education Courses

CC : Co-Curricular Courses

IKS : Indian Knowledge System

OJT : On Job Training

FP : Field Project

VSC : Vocational Skill Courses

CEP : Community Engagement Project

Semester 1 (First Year) Level 4.5

Progressive Education Society's

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First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code : 23ScMatU1101

Course Name : Algebra

Teaching Scheme: TH: 4 Hours/Week

Credit : 04

Examination Scheme: CIA : 40 Marks

End-Sem : 60 Marks

Prerequisite Courses:

- Basic knowledge of Real numbers and Complex number systems.
- Basic Set theory, Cartesian products, Relations and functions.
- Basic theory of matrices.

Course Objectives:

- To study properties of functions and inverse functions.
- 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 Division Algorithm in $R[x]$
- To study the system of linear equations.
- To study De Moivre's theorem and its applications.

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

- Various properties of relations and functions.
- G.C.D., L.C.M. and properties of divisibility in integers and polynomials
- Consistency and methods of solving systems of linear equations.
- Geometry of complex numbers and applications of complex numbers in finding the roots of polynomials.

Course Contents

Unit 1	Sets and Functions	10 lectures
	• Sets, Relations, Functions • Bijective functions, Composition of functions, Inverse functions. • Graphs of functions.	
Unit 2	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 3	Polynomials	10 lectures
	• Definition and examples. • Algebra of polynomials. • Division Algorithm in $R[x]$, GCD of polynomials and Euclidean Algorithm for polynomials • Factor theorem and Remainder theorem • Factorisation in $R[x]$	
Unit 4	System of 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.	
Unit 5	Complex Numbers	10 lectures
	• Modulus and amplitude of a complex number, Polar form , • De-Moivre's Theorem and its application • Roots of unity	

Reference Books :

1. Methods of Real Analysis by R.R. Goldberg, Oxford and IBH Publications, 1970.
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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First Year of B.Sc.
(2023 Course under NEP 2020)
Course Code :23ScMatU1102 Course Name : Mathematics Practical I

Teaching Scheme: PR: 4 Hours/Week

Credit : 02

Examination Scheme: CIA : 20 Marks

End-Sem : 30 Marks

Prerequisite Course : Algebra.

Course Objective:The student should be able to solve problems depending on the contents in Algebra.

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

- Understand the theoretical concepts in Algebra.
- 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 in $R[x]$

Practical 10 : Factorisation in $R[x]$

Practical 11 : Echelon forms

Practical 12 : Consistency of system of equations

Practical 13 : Gauss elimination and Gauss Jordan method

Practical 14 : Geometrical approach of Complex numbers

Practical 15 : De-Moivre's theorem

Reference Books :

1. Methods of Real Analysis by R.R. Goldberg, Oxford and IBH Publications, 1970.
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. Introduction to Real Analysis by Robert G. Bartle and Donald and R Sherbert,
John Wiley & Sons(3rd Edition), 2000.

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First Year of B.Sc.
(2023 Course under NEP 2020)
Course Code : 23ScMatU1401 Course Name : Fundamentals of Mathematics

Teaching Scheme: TH: 2 Hours/Week

Credit : 02

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. Introduction to Real Analysis by Robert G. Bartle and Donald & R Sherbert, John Wiley & Sons, (3rd Edition), 2000.
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, Nineth Revised Edition, 2002.

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First Year of B.Sc.
(2023 Course under NEP 2020)

Course Code : 23ScMatU1501

Teaching Scheme: PR: 4 Hours/Week

Examination Scheme: CIA : 20 Marks

Course Name : Logic

Credit : 02

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.

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First Year of B.Sc.
(2023 Course under NEP 2020)

Course Code : 23ScMatU1601

Course Name : Analytical Geometry

Teaching Scheme: PR: 4 Hours/Week

Credit: 02

Examination Scheme: CIA : 20 Marks

End-Sem : 30 Marks

Prerequisite:

- Basic knowledge of cartesian coordinate system up to three dimensions.
- Basic knowledge of standard form of conic sections.

Course Objectives: The aim of this course is

- To study lines and planes in three-dimensional space.
- To study the conics and their properties using Geogebra.

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

- Understand reduction of a conic to standard form.
- Visualize and understand geometry of three dimensional objects with Geogebra.

Course Contents

Practical 1 : Direction cosines and direction ratios.

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 : Equation of a plane

Practical 8 : Angle between two planes

Practical 9 : Lines and Planes

Practical 10 : System of Planes

Practical 11 : Bisector planes

Practical 12: Equations of sphere

Practical 13: Tangent Plane to sphere

Practical 14: Equations of cylinder

Practical 15: Equations of cone

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.

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First Year of B.Sc.
(2023 Course under NEP 2020)
Course Code : 23ScMatU1901 **Course Name : Ancient Mathematics**

Teaching Scheme: TH: 2 Hours/Week

Credit: 02

Examination Scheme: CIA : 20 Marks

End-Sem : 30 Marks

Pre-requisites: Basic operations of arithmetic.

Course Objectives:

- To understand the glorious history of mathematics
- To understand the valuable contribution by Indian mathematicians in the universe.

Course Outcomes:

- This course will help the students to understand the easy methods for arithmetic operations.
- Students have the opportunity to elaborate and extend their knowledge of mathematics.

Course Contents

Unit 1	History of Mathematics	15 lectures
	● What is Mathematics? ● Skills to learn Mathematics ● Ancient mathematics ● Ancient Indian Mathematicians ● Contribution of ancient scientists in Mathematics	
Unit 2	Vedic Mathematics	15 lectures
	● Arithmetical Computations, Multiplication, Division ● Factorization ● Simultaneous Simple Equations ● Quadratic and Cubic Equations ● Divisibility ● Elementary Squaring and Cubing ● Square roots and Cube roots	

Reference Books:

1. Ramanujan and Ancient Indian Mathematics by Swapana Banerjee, Create Space Independent Publishing Platform, 2019.
2. A modern introduction to Ancient Indian Mathematics by T. S. Bhanu Murthy, New Age International, 1993.
3. Vedic Mathematics by Jagadguru Swami Sri B. K. Tirthaji Maharaj, Motilal Banarsidass Publishers Pvt. Ltd., Delhi, 1992.
4. https://en.wikipedia.org/wiki/Indian_mathematics (02/06/2023).
5. <https://motion.ac.in/blog/top-10-famous-indian-mathematicians-and-their-contributions/> (02/06/2023).

Semester 2 (First Year) Level 4.5

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First Year B.Sc.

(2023 Course under NEP 2020)

Course Code : 23ScMatU2101

Course Name : Calculus

Teaching Scheme: TH: 4 Hours/Week

Credit: 04

Examination Scheme: CIA : 40 Marks

End-Sem : 60 Marks

Prerequisite Courses:

- Basic knowledge of real numbers, Sets and Intervals
- Basic knowledge of limit, continuity and derivative 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 its geometrical interpretation.
- To study the applications of mean value theorems and successive differentiation.

Course Outcomes: Student will be able to

- Understand basic properties of real numbers.
- Understand the concept of limit, continuity and differentiability.
- Understand applications of Mean value theorems and use of nth derivative of real valued function of real variable.

Course Contents

Unit 1	Real numbers	10 lectures
	• The algebraic and order properties of real numbers. • Absolute value of real numbers, Triangle inequality and its applications. • Neighborhood and deleted neighborhood of a real number and illustrations. • Bounded set, supremum (LUB) and infimum (GLB) of a subset of real numbers, Completeness property of real numbers.	
Unit 2	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 on a closed and bounded interval with respect to boundedness, attains its bounds, location of roots and Intermediate value theorem.	
Unit 3	Differentiation	10 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 4	Mean Value Theorems	12 lectures
	• Vanishing of a derivative at an extremum. • Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem. • Applications of mean value theorem. • Indeterminate forms, L Hospital's rule. • n^{th} derivatives of standard functions. • Leibnitz's theorem and its applications. • Taylor's and Maclaurin's theorem with Lagrange's form of remainder, Examples with assumption of convergence of series.	
Unit 5	Sequences of real numbers	10 lectures
	• Sequences and limit of sequence • Subsequences • Monotone sequence • Bounded Sequence • Convergence of sequence • Divergence of sequence	
Unit 6	Series of real numbers	8 lectures
	• Series of real numbers • Convergence of series • Tests of convergence of series	

Reference Books :

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, John Wiley & Sons (3rd Edition), 2000.
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.

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First Year of B.Sc
(2023 Course under NEP 2020)

Course Code: 23ScMatU2102 **Course Name: Mathematics Practical II**
Teaching Scheme: PR: 4 Hours/Week **Credit: 02**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Course: Calculus

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

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.

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 with application

Practical 9: Lagrange's Mean Value Theorem and applications

Practical 10: Cauchy Mean Value Theorem with applications

Practical 11: Indeterminate forms

Practical 12: Successive differentiation

Practical 13: Taylor's Theorem

Practical 14: Sequence of real numbers

Practical 15: Series of real numbers

Reference Books :

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, John Wiley & Sons (3rd Edition), 2000.
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.

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First Year of B.Sc.
(2023 Course under NEP 2020)

Course Code : 23ScMatU2201 Course Name : Practicals on Mathematical Logic

Teaching Scheme: PR: 4 Hours/Week

Credit : 02

Examination Scheme: CIA : 20 Marks

End-Sem : 30 Marks

Prerequisite: 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

Practical 12 : Method of Contraposition

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.

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Modern College of Arts, Science and Commerce (Autonomous),

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First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code : 23ScMatU2401

Course Name : Business Mathematics

Teaching Scheme: TH: 2 Hours/Week

Credit: 02

Examination Scheme: CIA : 20 Marks

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

Reference Books :

4. Practical Business Mathematics by S.A.Bari, New Literature Publishing Company, 1977.
5. Business Mathematics by V. K. Kapoor, Sultan Chand And Sons, 1982.
6. Business Mathematics by D. C. Sancheti and V. K. Kapoor, Sultan Chand and Sons, 1993.
7. 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.

(2023 Course under NEP 2020)

Course Code : 23ScMatU2501

Course Name : Discrete Mathematics

Teaching Scheme: PR: 4 Hours/Week

Credit : 02

Examination Scheme: CIA : 20 Marks

End-Sem : 30 Marks

Prerequisite: Basic knowledge of counting, permutations and combinations.

Course Objectives: The aim of this course is

- To study counting principles.
- To study recurrence relations
- To study Generating functions, partitions, Polya enumeration
- To study Posets.

Course Outcomes:

On completion of the course, student will able to understand

- The mathematical tools to solve the problems in Combinatorics.
- The theory of Posets.

Course Contents

Practical 1 : Basic Counting Principles

Practical 2 : Arrangements and Selections without repetitions

Practical 3 : Arrangements and Selections with repetitions

Practical 4 : Distributions

Practical 5 : Binomial Identities

Practical 6 : Inclusion-Exclusion Principle

Practical 7 : Homogeneous recurrence relations

Practical 8 : Non-homogeneous recurrence relations

Practical 9 : Generating functions

Practical 10 : Partitions

Practical 11 : Rook's Polynomial

Practical 12 : Polya Enumeration formula

Practical 13 : Posets

Practical 14 : Lattices

Practical 15 : Isomorphism of Posets

Reference Books:

1. Discrete Mathematics and Its Applications by Kenneth H Rosen, McGraw Hill, Seventh Edition, 2011.
2. Discrete Mathematical Structures by Bernard Kolman, Robert C. Busby, Sharon Cutler Ross and Nadeem-ur-Rehman, Pearson Education, Fifth Edition, 2004.
3. Applied Combinatorics by Alan Tucker, Fourth Edition, 2001.
4. General Lattice Theory by George Gratzner, Birkhauser, Second edition, 2002.

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First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code : 23ScMatU2601

Course Name : Computational Geometry

Teaching Scheme: PR: 4 Hours/Week

Credit: 02

Examination Scheme: CIA : 20 Marks

End-Sem : 30 Marks

Prerequisite Courses : Matrix Algebra, Analytical Geometry and Scilab

Course Objectives: The aim of this course is to study

- The use of matrices in representation of objects and transformations.
- The affine transformations of two and three dimensional objects.
- The concept of projections and its various types.
- Matrix operations using Scilab

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

- The applications of matrices in affine transformations of two and three dimensional objects.
- The applications of computational geometry in the field of architecture, animation, designing and civil engineering.
- The polynomial approximation of given discrete data.
- The matrix operations and transformations using Scilab

Course Contents

Practical 1 : Two dimensional transformations

Practical 2: Transformation of lines

Practical 3 : Combined transformations

Practical 4 : Solid body transformations

Practical 5 : Homogeneous coordinates

Practical 6: Rotation about arbitrary point

Practical 7 : Reflection through arbitrary line

Practical 8 : Three dimensional transformations

Practical 9 : Rotations about standard axes

Practical 10 : Reflections through standard planes

Practical 11 : Arbitrary rotations and reflections

Practical 12 : Orthographic and Axonometric projections

Practical 13 : Oblique and perspective projections

Practical 14 : Generation of points on circle and ellipse

Practical 15 : Generation of points on parabola and hyperbola

Reference Books:

1. Mathematical elements for Computer graphics by D. F. Rogers, J. A. Adams, Tata Mc Graw Hill International Edition, Second edition, 2002.
2. Computer Graphics with Open GL by Donald Hearn and M. Pauline Baker, Warren Carithers, Pearson (4th Edition), 2014.
3. Computer Graphics by Schaum's Outline Series, Tata Mc Graw Hill International Edition, 2015.