M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to SavitribaiPhule Pune University
NAAC accredited 'A' Grade

(Faculty of Science & Technology)

Syllabus of

F.Y. B.Sc. Mathematics

Choice Based Credit System Syllabus
To be implemented from the academic year 2021-2022

Title of the Course: B. Sc (Mathematics)

Preamble:

Department of Mathematics, Abeda Inamdar Senior College is implementing the first syllabus of B.Sc. under autonomy in June 2021. Taking into consideration the rapid changes in Science and Technology and new approaches in different areas of Mathematics and related subjects, the Board of studies in Mathematics has prepared the syllabus of B.Sc Semester-I and Semester-II(w.e.f. 2021-22) Mathematics course under the Choice Based Credit System (CBCS).

The model curriculum was developed by U.G.C. is used as a guideline for the present syllabus.

Aims:

Sr. No.	Aims
1.	Give the students a sufficient knowledge of fundamental principles, methods, and a clear perception of innumerous powers of mathematical ideas and tools and know-how to use them bymodeling, solving, and interpreting.
2.	Reflecting the broad nature of the subject and developing mathematical tools for continuingfurther study in various fields of science and technology.
3.	Enhancing student's overall development and equipping them with mathematical modelingabilities, problem solving skills, creative talent, and power of communication necessary for various kinds of employment.
4.	Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Objectives:

Sr. No.	Objectives
1.	A student should be able to recall basic facts about mathematics and should be able to displayknowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.
2.	A student should get a relational understanding of mathematical concepts and concernedstructures and should be able to follow the patterns involved, mathematical reasoning.
3.	A student should get adequate exposure to global and local concerns that explore manyaspects of Mathematical Sciences.
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5.	A student should be able to apply their skills and knowledge that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae ortechniques to process the information, and draw the relevant conclusion.
6.	A student should be made aware of the history of mathematics and hence of its past, present,and future role as part of our culture.

Course Outcome:

Sr. No.	Outcome
1.	The mathematical maturity of students in their current and future courses shallDevelop.
2.	The student develops theoretical, applied, and computational skills.
3.	The student gains confidence in proving theorems and solving problems.

For Continuous Internal Evaluation (CIE), Evaluation will be done continuously. Internal assessment will be of **20** marks for a paper of 50 Marks. These 20 marks are divided as follows:
CIE for 2 Credits Theory Paper: It will be divided as follow:

Sr. No.	Components		Marks
1.	CIE I	There will be a compulsory Test on Demand MCQ Examination of **20** marks of each subject which would be converted into **5 Marks.**	5
2.	CIE II	Two Class Tests 10 Marks Each. Converted to 5 Marks.	5
3.	CIE III	Mid Sem Exam of 20 Marks converted to 05 Marks.	5
4.	CIE IV	Participation in two activities at department/ college level 05 Marks	5
		In case of students failing to score under category (d), the attendance can be considered to give marks	
		Total	20

CIE for 1.5 Credits Practical Paper: It will be divided as follow:

Sr. No.	Components		Marks
1	CIE I	There will be a compulsory Mock Practical Examination, Viva Voce of subjects mentioned in for **20 Marks**.	20

Methods of Internal Assessment

Written exam	Quiz
Presentations	Projects
Assignments	Tutorials
Oral examination	Open Book Test and Others

Structure of the F.Y.B.Sc Mathematics course:

	Semester-I		**Semester-II**		**Continuous Internal Evaluation (CIE) (Internal Marks)**	**End Semester Exam (External Marks)**	**Total Marks**	**Credits**
Paper-I	21SBMT111	Foundation of Mathematics	21SBMT121	Co-ordinate Geometry	20	30	50	2
Paper-II	21SBMT112	Calculus-I	21SBMT122	Calculus-II	20	30	50	2
Paper-III	21SBMT113	Operation Research and Software Maxima	21SBMT123	Abstract Algebra and Software Maxima	20	30	50	1.5

Structure of S. Y. B. Sc. Mathematics Courses:

	Semester-III		**Semester-IV**		**Credit**
Paper-I	21SBMT231	Calculus of Several Variables	21SBMT241	Linear Algebra-I	2
Paper-II	21SBMT232A	Laplace Transform and Fourier Series	21SBMT242A	Vector Calculus	2
	21SBMT232B	Computational Geometry	21SBMT242B	Combinatorics	2
Paper-III	21SBMT233	Numerical Analysis and Scilab	21SBMT243	Ordinary Differential Equation and Scilab	1.5

Structure of T. Y. B. Sc. Mathematics Courses:

Semester-V		Semester-VI		Credit
21SBMT351	Metric Spaces	21SBMT361	Complex Analysis	2
21SBMT352	Real Analysis-I	21SBMT362	Real Analysis-II	2
21SBMT353	Practical Course on Metric Spaces and Real Analysis-I	21SBMT363	Practical Course on Complex Analysis and Real Analysis-II	2
21SBMT354	Group Theory	21SBMT364	Ring Theory	2
21SBMT355	Partial Differential Equations	21SBMT365	Number Theory	2
21SBMT356	Practical Course on Group Theory and Partial Differential Equations	21SBMT366	Practical Course on Ring Theory and Number Theory	2
Select Any Two Out Of Six Courses				
21SBMT357A	Operations Research	21SBMT367A	Optimization Technique	2
21SBMT357B	C- Programming	21SBMT367B	C-Programming	2
21SBMT357C	Python Course - I	21SBMT367C	Python Course - II	2
21SBMT357D	Machine Learning Course - I	21SBMT367D	Machine Learning Course - II	2
21SBMT357E	Lattice Theory	21SBMT367E	Differential Geometry	2
21SBMT357F	Graph theory	21SBMT367F	Lebesgue Integration	2

21SBMT358	Practical based on papers selected from SBMT357A to SBMT357F	21SBMT368	Practical based on papers selected from SBMT367A to SBMT367F	2
Skill enhancement course				
21SBMT359	Skill Enhancement Course-LATEX-I	21SBMT369	Skill Enhancement Course-LATEX-II	2
21SBMT3510	Skill Enhancement Course-Geogebra	21SBMT3610	Skill Enhancement Course-SAGE	2

All three above courses are compulsory.

Details of Syllabus:

Semester-I

21SBMT111- Foundation of Mathematics

Course/ Paper Title	Foundation of Mathematics
Course Code	21SBMT111
Semester	I
No. of Credits	2

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Sets Relations and Functions**	**08**
	1. Basic terminologies of sets, Operations on sets, Family of sets, Power sets,Cartesian product of sets.	2
	2. Basic definitions of functions, One-one, onto functions and bijections, Composition of functions, Inverse of a function, Image of subsets under functions, Inverse image of subsets under functions. (Excluding theorem only examples)	3
	3. Relations on sets, Types of relations, Equivalence relations, Equivalence classes, andpartitions of sets.	3
Unit II	**Divisibility Theory in the Integers**	**10**
	1. Basic terminologies of sets, Operations on sets, Family of sets, Power sets,Cartesian product of sets.	5
	2. The Division Algorithm, The Greatest Common Divisor, The Euclidean Algorithm.	5
Unit III	**Primes and the theory of Congruence**	**08**
	1. The Fundamental Theorem of Arithmetic: Prime Numbers, Euclid's Lemma.	3
	2. Basic Properties of Congruence.	2

	3. Fermat's Theorem.	3
Unit IV	**Complex Numbers**	**10**
	1. Sums and Products, Basic Algebraic Properties, Moduli, Complex Conjugates, Exponential Form, Products and Quotients, De-Moivre's theorem. 2. Roots of Complex Numbers: The n^{th} roots of unity. 3. Regions in Complex Plane.	4 4 2

Textbooks:

1. A Foundation Course in Mathematics, Ajit Kumar, S. Kumaresan and Bhaba Kumar Sarma, Narosa Publication House.

Unit I: Chapter 2: Sec. 2.1 to 2.5, Chapter 3: Sec. 3.1 to 3.6, Chapter 4: Sec. 4.1 to 4.4.

2. Elementary Number Theory, David M. Burton, Tata McGraw Hill, Sixth Edition

Unit II: Chapter 1: Sec. 1. 1 , Chapter 2: Sec. 2.2 to 2.4.

Unit III: Chapter 3: Sec. 3.1, Chapter 4: Sec. 4.1, 4.2, Chapter 5: Sec. 5.2.

3. Complex Variables and Applications, James Ward Brown and Ruel V. Churchill, Mc-Graw Hill, Seventh Edition**.**

Unit IV: Chapter 1: Sec 1 to 10.

Reference Books:

1. Textbook of Algebra, S. K. Shah and S. C. Garg, Vikas Publishing House Pvt. Ltd. Edition 2017.
2. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and Sons Inc, Fourth Ed.

Website:

1. https://www.youtube.com/watch?v=md5UCR7mcIY
2. https://www.youtube.com/watch?v=C2qIoHkhEuM&list=PLOzRYVm0a65cpVtcdj_5SBEh6VQvC

Course/ Paper Title	Calculus-I
Course Code	21SBMT112
Semester	I
No. of Credits	2

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Real Numbers**	**08**
	1.The Algebraic and Order properties of R: Algebraic properties of R, Order properties of R, Well-Ordering Property of N.Arithmetic mean-Geometric mean inequality, Bernoulli's inequality. (Revision: essential properties should be revised with illustrativeexamples)	2
	2. Absolute Value and the Real Line: Absolute value function and its properties, triangle inequality and its consequences, a neighborhood of a point on a real line.	2
	3. The Completeness Property of R: Definitions of Upper bound, Lower bound, supremum, infimum of subsets ofR, completeness property of R.	2
	4. Applications of the Supremum Property: property and its consequences, The density theorem (withoutproof).	2
Unit II	**Sequences**	**10**
	1. Sequences and Their Limits: Definition and examples of sequences of real numbers, Definition of the limit ofsequence	2

	and uniqueness of limit, Examples on the limit of a sequence. 2.Limits Theorems: Definition of bounded sequence, Every convergent sequence is bounded,Algebra of limits. 3.Monotone Sequences: Definition and examples of monotone sequences, Monotone convergence theorem, and examples 4.Subsequences and Bolzano -Weierstrass Theorem: Definition of subsequence and examples, Divergence criteria, Monotone Subsequence theorem (without proof), Bolzano -Weierstrass theorem (firstproof). 5. Cauchy Criterion: Definition and examples.	2 2 2 2
Unit III	**Limits**	**08**
	1. Functions and their Graphs: Functions, domain and range, graphs of functions, representing a function numerically, and Vertical line test, Piecewise defined functions, increasing and decreasing functions, even and odd functions symmetry, common functions. 2. Limits of Functions: Definition of cluster point and examples, the definition of the limit of a function, the sequential criterionfor limits, divergence criteria. 3. Limit Theorems: Algebra of limits (proofs using sequential criterion), Squeeze theorem.	2 2 2

	4. Some extension of limit concepts: One-sided limits, infinite limits (without proof).	2
Unit IV	**Continuity**	**10**
	1. Continuous Functions: Definition of continuous function at a point, the sequential criterion for continuity,Divergence criterion, combination of continuous functions. 2.Continuous Functions on Intervals: Properties of continuous functions on an interval, Boundedness theorem (without proof), The minimum-maximum theorem(without proof), Location of roottheorem (Without proof), Bolzano's intermediate value theorem. Continuous function maps closed bounded interval to closed bounded interval, Preservation of interval theorem.	4 6

Textbooks:

1. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and SonsInc, Fourth Edition.

Unit I: Chapter 2: Sec 2.1 (2.1.1 to 2.1.13), Sec. 2.2 (2.2.1 to 2.2.9), Sec. 2.3,

Sec. 2.4 (2.4.1, 2.4.3 to 2.4.6, 2.4.8, 2.4.9).

Unit II: Chapter 3: Sec. 3.1 (3.1.1 to 3.1.7, 3.1.10, 3.1.11), Sec. 3.2 (3.2.1 to

3.2.11), Sec. 3.3 (3.3.1, 3.3.4), Sec. 3.4 (3.4.1 to 3.4.3, 3.4.5 to 3.4.8), Sec. 3.5.

Unit III: Chapter 4: Sec. 4.1 (4.1.1, 4.1.3 to 4.1.9), Sec. 4.2 (4.2.1 to 4.2.8), Sec.

4.3 (4.3.1 to 4.3.9).

Unit IV: Chapter 5: Sec. 5.1, Sec. 5.2, Sec 5.3 (5.3.1 to 5.3.5, 5.3.7 to 5.3.10).

2. Thomas'Calculus, Fourteenth edition, Pearson Publication.

Unit III: Chapter 1: Sec. 1.1.

Reference Books:

1 Introduction to Real analysis, William F.Trench, Free edition, 2010.

2 Calculus of a single variable Ron Larson, Bruce Edwards, tenth edition.

Brooke Cole. Cengage Learning

3 Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.

4 Calculus and its Applications, Marvin L. Bittinger, David J. Ellenbogen and Scott A. Surgent, Addison Wesley, tenth edition

Website: 1. https://www.youtube.com/watch?v=fCzS8y4SBtE

2. https://www.youtube.com/watch?v=wzFc9us78sM

Course/ Paper Title	Operations Research and Software Maxima
Course Code	21SBMT113
Semester	I
No. of Credits	1.5

Syllabus

Unit No	Title with Contents	No. of Practicals
Unit I	**Basics of Operation Research**	**02**
	1. Development of Operation Research. 2. Definition of Operation Research. 3. Characteristics of Operation Research. 4. Formulating the Problem	
Unit II	**Linear Programming**	**07**
	1. Introduction. 2. Requirements for Linear Programming Problem. 3. Assumption in Linear Programming Models. 4. Application of Linear Programming Methods. 5. Areas of Application of Linear Programming. 6. Formulation of Linear Programming Problems. 7. Advantages of Linear Programming Methods. 8. Limitation of Linear Programming Models. 9. Graphical Method of Solution.	

	10.Some exceptional Cases. 11. The General Linear Programming Problem. 12. Canonical and Standard Forms of Linear Programming Problems. 13. Theory of Simplex Method. 14. Some Important Definition. 15. The Simplex Method.	
Unit III	**Practical Based on Maxima**	**03**
	1. Basics: Loading Packages, Sets, Function, Complex Numbers. 2. Plots in 2D, Plots in 3D. 3. Limits, Continuity, and Sequences.	

Textbook:

1. Prem Kumar Gupta, Dr. D.S. Hira Operation Research S.Chand Seventh Revised Edition 2014

Unit I: Chapter 1: Sec 1.1 to 1.3, Sec 1.12-1.

Unit II: Chapter 2: Sec 2.1 to 2.14, Sec 2.16.

Reference Books:

1. Frederick S. Hillier, Gerald J. Lieberman, Introduction to Operation Research (Eighth Edition) Tata McGraw Hill.

2. J K Sharma, Operations Research (Theory and Applications, second edition, 2006), Macmilan India Ltd.

Website:

1.https://www.youtube.com/watch?v=a2QgdDk4Xjw&list=PLjc8ejfjpgTf0LaDEHgLB3gCHZYcNtsoX

2. https://www.youtube.com/watch?v=66aKgySf9vo&list=PLLy_2iUCG87Bq8RGMTdeFZiB-87V4i9p1

3. TORA and EXCEL Software, MAXIMA Software.

SEMESTER: II

Course/ Paper Title	**Co-ordinate Geometry**
Course Code	**21SBMT121**
Semester	II
No. of Credits	2

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Analytical Geometry of Two Dimension**	**10**
	1. Change of axes: translation and rotation. 2. Conic Sections: General equation of second degree in two variables 3. Reduction to standard form, the center of conic, nature of conic.	3 3 4
Unit II	**Planes**	**10**
	1.Direction cosines and direction ratios, Equation of plane, Normal form, Transform to thenormal form, Plane passing through three non-collinear points, Intercept form, Angle between two planes. 2. Distance of a point from a plane, Distance between parallel planes, Systems of planes, twosides of planes, Bisector planes.	5 5
Unit III	**Lines in three dimension**	**08**
	1. Equations of a line in Symmetric and unsymmetrical forms, Line passing throughtwo points, Angle between a line and a plane. 2. Perpendicular distance of a point from a plane, Condition for two lines to becoplanar (without proof).	4 4

Unit IV	Sphere	08
	1. Equation of a sphere in different forms, plane section of a sphere. 2.Equation of a circle, sphere through a given circle 3. Intersection of a sphere and a line, Equation of tangent plane to a sphere.	2 3 3

Textbooks:

1. Analytic Geometry in Two and Three Dimensions : Von Steuben.
   Unit I: Chapter 8: Sec, 8.4.
2. Analytical Solid Geometry: Shantinarayan; S. Chand and Company Ltd, New Delhi, 1998.
   Unit II: Chapter 1:Sec. 1.6, 1.7, Chapter 2:Sec. 2.1 to 2.7.
   Unit III: Chapter 3:Sec. 3.1 to 3.4, 3.7.
   Unit IV: Chapter 6:Sec. 6.1 to 6.6.

Reference Book:

1. P.K.Jain and Khalil Ahmad, A Text Book of Analytical Geometry of ThreeDimensions, Wiley Eastern Ltd. 1999.

Website:

1. https://www.youtube.com/watch?v=HyWagR_

Course/ Paper Title	Calculus-II
Course Code	21SBMT122
Semester	II
No. of Credits	2

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Differentiation**	**10**
	1. The Derivatives: Definition of the derivative of a function at a point, every differentiable function is continuous, Rules of differentiation, Caratheodary's theorem (without proof), The chain rule, Derivative of inverse function (without proof, only examples). 2.The Mean Value Theorems: Interior extremum theorem, Mean Value theorems, and theirConsequences, Intervals of increasing and decreasing of a function, first derivative test for extrema	5 5
Unit II	**L'Hospital Rule and Successive Differentiation**	**10**
	1. L` Hospital Rule: Indeterminate forms, L'Hospital Rules (without proof). 2. Taylor's theorem: Taylor's theorem and Maclaurin's theorem with Lagrange'sform of the remainder (Without proof). 3. Successive Differentiation: The nth derivative and Leibnitz theorem for Successive differentiation.	3 3 4
Unit III	**Ordinary Differential Equations**	**08**
	1. Linear first order equations. 2. Separable equations.	3 3

	3. Existence and Uniqueness of solutions of nonlinear equations.	2
Unit IV	**Exact Differential Equations**	**08**
	1. Transformation of nonlinear equations to separable equations. 2. Exact differential equations. 3.Integrating factors	2 2 4

Textbooks:

1. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and Sons,Inc., Fourth Edition.

Unit I: Chapter 6: Sec. 6.1(6.1.1 to 6.1.8), Sec 6.2(6.2.1 to 6.2.8).

Unit II: Chapter 6: Sec 6.3(6.3.1 to 6.3.7), Sec 6.4(6.4.1 to 6.4.3).

2. Differential Calculus by Shanti Narayan, Tenth Revised Edition.

Unit II: Chapter 5: Sec. 5.1 to 5.6.

3. Elementary Differential equations, William F. Trench, E-book (Free download)

Unit III: Chapter 2: Sec 2.1 to 2.3.

Unit IV: Chapter 2: Sec 2.4 to 2.6.

Reference Books:

1. Introduction to Real analysis, William F. Trench, Free edition, 2010.

2. Calculus of a single variable Ron Larson , Bruce Edwards, tenth edition.

3. Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.

4. Calculus and its Applications, Marvin L. Bittinger, David J. Ellenbogen and Scott A. Surgent, Addison Wesley, tenth edition.

5. Ordinary and Partial Differential Equations, M.D. Raisingania, S. ChandAnd Company,2009.

Website:

1. https://www.youtube.com/watch?v=FvYC5gB89Kc

2. https://www.youtube.com/watch?v=Im242eBqaxw

Course/ Paper Title	Abstract Algebra and Software Maxima
Course Code	21SBMT123
Semester	II
No. of Credits	1.5

Syllabus

Unit No	Title with Contents	No. of Practicals
Unit I	**Binary Operations**	**02**
	1. Definitions and examples 2. Commutative Composition 3.Associative Composition	
Unit II	**Isomorphic Binary Structures**	**03**
	1. Binary Algebraic Structures 2. Binary Structures 3.Structural Property	
Unit III	**Groups**	**03**
	1. Definition and Examples 2. Finite Group and Group tables	
Unit IV	**Practical Based on Maxima**	**04**
	1.Analytic Geometry of two dimensions 2.Planes 3.Lines in three dimensions 4.Sphere 5.Introduction to derivatives 6.Products, quotients, and linear combinations 7.The chain rule 8.Solving ordinary differential equations 9.Direction Fields	

Textbook:

1. John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson.

   Unit I: Chapter 1- Sec 2.

   Unit II: Chapter 1- Sec 3.

   Unit IV: Chapter 1-Sec 4.

Reference Books:

1. M. Artin, Algebra, Prentice Hall of India, New Delhi, 1994.

2.P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra, Second Ed., Foundation Books, New Delhi, 1995.

3. I.N.Herstien, Topis in Algebra, John Wileyy and Sons.

4. Joseph. A. Gallian, Contemporary Abstract Algebra, (4th Edition),Narosa Publishing House.

5. D.A.R. Wallace, Groups, Rings and Fields, Springer Verlag, London, 1998.

Website:

1. https://www.youtube.com/watch?v=4V_KYo6sMJs
2. https://www.youtube.com/watch?v=EiNhEl5AIwA