Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune 5

(An Autonomous College Affiliated to SavitribaiPhule Pune University)

Detailed Syllabus

For B.Sc. (Mathematics)

(2019-20 Course)

(with effect from 2019-20)

CIA: Continuous Internal Evaluation

Semester 1 (First Year)- B.Sc. Regular

Course Type	Course Code	Course / Paper Title	Hours / Week	Credit	CIA	End Sem Exam	Total
CCT-1	19ScMatU101	Algebra	3	2	40	60	100
CCT-2	19ScMatU102	Differential Calculus	3	2	40	60	100
CCP-1	19ScMatU103	Mathematics Practical – I	4	2	40	60	100
Total			**10**	**6**	**120**	**180**	**300**

Semester 2 (First Year)- B.Sc. Regular

Course Type	Course Code	Course / Paper Title	Hours / Week	Credit	CIA	End Sem Exam	Total
CCT-3	19ScMatU201	Analytical Geometry	3	2	40	60	100
CCT-4	19ScMatU202	Integral Calculus	3	2	40	60	100
CCP-2	19ScMatU203	Mathematics Practical – II	4	2	40	60	100
Total			**10**	**6**	**120**	**180**	**300**

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Modern College of Arts, Science and Commerce (Autonomous),
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First Year of B.Sc. (Mathematics) (2019 Course)

Course Code: 19ScMatU101
Course Name: Algebra

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**

Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Prerequisites:

- 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.
- Number theoretic properties using division algorithm for integers, Euler's theorem and Fermat's theorem.
- Congruence relations on the set of integers.
- System of linear equations.
- 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.
- Greatest common divisor, Least common multiple and properties of divisibility.
- Consistency and methods of solving system of linear equations.
- Geometry of complex numbers and applications of complex numbers in finding the roots of polynomials.

Course Contents:

Chapter 1	**Sets and Functions**	5 lectures
	• Sets, Relations, Functions. • Bijective functions, Composition of functions,Inverse functions.	
Chapter 2	**Integers**	16 lectures
	• Well ordering property for natural numbers and principles of induction. • Divisibility in integers, Division algorithm.	

	• G.C.D. and L.C.M of two integers. • Prime and composite integers, Euclid'slemma, Unique factorization theorem. • Congruence relation and its properties. • Euler's theorem and Fermat's theorem.	
Chapter 3	**System of Linear equations**	8 lectures
	• Homogeneous and non-homogeneous system of linear equations. • Matrix form of system of equations. • Row echelon form, Row reduced echelon form, Rank of a matrix, Consistency of a system of linear equations. • Solving system of linear equations using Gauss elimination and Gauss Jordan method.	
Chapter 4	**Complex Numbers**	6 lectures
	• Modulus and amplitude of a complex number, Polar form. • De-Moivre'stheorem and its application. • Roots of unity.	
Guidance/ Discussion on course specific experiential learning through field work		1 lecture

Total: 36 Lectures

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 ShantiNarayan, S. Chand and Co., New Delhi, 1957.

4. Complex Variables and Applications by Ruel. V. Churchill; McGraw Hill Company, 8thEdition,2009.

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First Year of B.Sc. (Mathematics) (2019 Course)

Course Code: 19ScMatU102
Course Name: Differential Calculus

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**
Examination Scheme: CIA: 40 Marks **End-Sem:60 Marks**

Prerequisites:

- Basic knowledge of real numbers, 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 variable.
- 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.
- Concept of limit, continuity and differentiability.
- Applications of Mean value theorems and use of nth derivative of real valued function of real variable.

Course Contents:

Chapter 1	Real numbers	5 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.	
Chapter 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 interval • Properties of continuous functions on a closed and bounded interval with respect to boundedness, attains its bounds, location of roots and Intermediate value theorem.	
Chapter 3	Differentiation	6 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.	
Chapter 4	Mean Value Theorems	8 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 Hopital's rule.	
Chapter 5	Successive Differentiation	6 lectures
	• 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.	
Guidance/ Discussion on course specific experiential learning through field work		1 lecture

Total: 36 Lectures

Reference Books:

1. Introduction to Real Analysis by Robert G. Bartle and Donald R Sherbert, John Wiley

and 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 P. K. Mittal, S. Chand and Co., New Delhi, 11th Edition, 2005.

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First Year of B.Sc. (Mathematics) (2019 Course)

Course Code: 19ScMatU103
Course Name: Mathematics Practical - I

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**

Examination Scheme: CIA: 40 Marks **End-Sem:60 Marks**

Prerequisite Courses:

- Preparation of Mathematics Paper I (Algebra) and Paper II (Differential Calculus) assigned by BOS under autonomy.

Course Objectives:

- The student should be able to solve problems depending on contents in Algebra and Differential Calculus.

Course Outcomes:

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

- Understand the theoretical concepts in Algebra and Differential Calculus.
- Apply this knowledge in various courses of Science and Technology.

Course Contents:

Practical 1: Sets and Functions
Practical 2: Divisibility in integers
Practical 3: Congruence modulo n in integers
Practical 4: Solutions of systems
Practical 5: Consistency of systems
Practical 6: Complex numbers
Practical 7: Real numbers
Practical 8: Limits and Continuity
Practical 9: Differentiation
Practical 10: Mean value theorems
Practical 11: Successive differentiation
Practical 12: Miscellaneous problems in Differential Calculus

Note: There will be 4 lectures for each practical session per week.

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 (8th Edition) by Ruel. V. Churchill; McGraw Hill Company – 2009.
5. Introduction to Real Analysis by Robert G. Bartle and Donald R Sherbert (3^{rd} Edition), John Wiley & Sons, 2000.
6. Calculus Volume I – One Variable Calculus with Introduction to Linear Algebra (2^{nd} Edition) by Tom M. Apostol, John Wiley and Sons, 2002.
7. Differential Calculus by Shanti Narayan and Mittal P.K. (11^{th} Edition), S. Chand and Co., New Delhi, 2005.

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First Year of B.Sc. (Mathematics) (2019 Course)

Course Code: 19ScMatU201
Course Name: Analytical Geometry

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**

Examination Scheme: CIA: 40 Marks **End-Sem:60 Marks**

Prerequisites:

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

Course Objectives:

- To study conic sections in general form and their reduction to standard forms.
- To study planes, lines and spheres in three dimensional space

Course Outcomes:

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

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

Course Contents:

Chapter 1	**Analytical geometry of two dimensions**	7 lectures
	• Shift of origin, rotations of axes. • Central conics and other conics in their standard form. • General equation of a conic of second degree in two variables and its reduction to standard form with classification.	
Chapter 2	**Planes in three dimensions**	10 lectures
	• Direction cosines and direction ratios of a line. • Equation of a plane, normal form, plane passing through three non-collinear points, Intercept form. • Distance of a point from a plane, Distance between parallel planes. • Systems of planes.	

	• Bisector planes.	
Chapter 3	**Lines in three dimensions**	10 lectures
	• Equation of a line in symmetric and asymmetric form. • Line passing through two points. • Angle between lines and planes. • Perpendicular distance of a point from a plane. • Condition for two lines to be coplanar. • Skew lines, shortest distance between skew lines, and equation of line of shortest distance between two skew lines.	
Chapter 4	**Spheres**	8 lectures
	• Equation of a sphere in standard and general form, diameter form. • Plane section of a sphere. • Equation of Sphere through a given circle. • Intersection of a sphere and a line. • Equation of tangent plane to sphere and condition of tangency.	
Guidance/ Discussion on course specific experiential learning through field work		1 lecture

Total: 36 Lectures

Reference Books:

1) Analytical Solid Geometry by Shanti Narayan, S. Chand and Company Ltd, New Delhi, 1998.

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

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First Year of B.Sc. (Mathematics) (2019 Course)

Course Code: 19ScMatU202
Course Name: Integral Calculus

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**
Examination Scheme: CIA: 40 Marks **End-Sem:60 Marks**

Prerequisites:

- Basic knowledge of integration by parts and integration by partial fractions.
- Basic knowledge of differential equations of variable separable form and linear differential equation.

Course Objectives:

- The aim of this course is to study indefinite integration as an antiderivative.
- To study the method of partial fractions, and integration of some irrational functions.
- To study reduction formulae and methods of solving first order first degree differential equations.
- To study applications of differential equations and non-linear differential equations.

Course Outcomes:

Student will be able to:

- Solve problems on integrations using partial fractions.
- Apply the methods of integration in other science subjects.
- Understand how to solve differential equations of first order and first degree.
- Understand how to solve differential equations of first order and higher degree.

Course Contents:

Chapter 1	Integration	5 lectures
	• Integration of rational functions by using partial fractions. • Integration of some irrational functions: $\int (ax+b)^{1/n} dx$, n is positive integer $\int \frac{Ax+B}{ax^2+bx+c} dx$, $\int \frac{AX+B}{\sqrt{ax^2+bx+c}} dx$, $\int (Ax+B)\sqrt{ax^2+bx+c}$ dx, $\int \frac{1}{(Ax+B)\sqrt{ax^2+bx+c}} dx$	

Chapter 2	Reduction Formulae	6 lectures
	• Reduction formula for $\int \frac{x^n}{\sqrt{ax^2+bx+c}}dx$ where n is a positive integer. • Reduction formula for $\int \frac{dx}{(x^2+a^2)^n}$ where n is positive integer. • Reduction formula for $\int (x^2 + a^2)^{n/2}\,dx$ where n is positive integer. • Reduction formula for $\int_0^{\pi/2} sin^n x dx$ and $\int_0^{\pi/2} cos^n x dx$ where n is positive integer.	
Chapter 3	Differential equations of first order and first degree	18 lectures
	• Introduction to function of 2 and 3 variables, homogeneous function, partial derivatives. • Differential equations, General solution of differential equations • Methods of finding solution of differential equation of first order and first degree, variable separable form, exact differential equations. • Integrating factors, methods of finding integrating factor. • Homogeneous differential equations, linear differential equations, Bernoulli's differential equation. • Applications of differential equations, orthogonal trajectories.	
Chapter 4	Methods of finding solution of differential equation of first order and higher degree	6 lectures
	• Differential equations solvable for p • Differential equations solvable for y • Differential equations solvable for x • Differential equations in Clairaut's form • Singular solutions	
Guidance/ Discussion on course specific experiential learning through field work		1 lecture

Total: 36 Lectures

Reference Books:

1. Integral Calculus by Shanti Narayan and P.K. Mittal, S. Chand & Company Pvt. Ltd.,

11^{th} Edition, 2005.

2. Elementary Differential Equations by Earl Rainville and Phillip Bedient, Collier Macmillan International Editions, 1969.

3. Ordinary and Partial Differential Equations by M.D. Raisinghania, S. Chand and Company, 2009.

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First Year of B.Sc. (Mathematics) (2019 Course)

Course Code: 19ScMatU203
Course Name: Mathematics Practical - II

Teaching Scheme: TH: 3 Hours/Week **Credit: 02**
Examination Scheme: CIA: 40 Marks **End-Sem:60 Marks**

Prerequisite Courses:

- Preparation of Mathematics Paper I (Geometry) and Paper II (Integral Calculus) assigned by BOS under autonomy.

Course Objectives:

- The student should be able to solve problems depending on contents in Paper I and Paper II.

Course Outcomes:

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

- Understand the theoretical concepts in Geometry and IntegralCalculus.
- Apply his knowledge in other subjects like Physics, Statistics and Electronics.

Course Contents:

Practical 1: Analytical Geometry in 2D
Practical 2: Planes in three dimensions – I
Practical 3: Planes in three dimensions – II
Practical 4: Lines in three dimensions
Practical 5: Spheres
Practical 6: Miscellaneous Problems in Geometry
Practical 7: Integration
Practical 8: Reduction formulae
Practical 9: Preliminaries of Differential Equations
Practical 10: Solution of differential equations of first order and first degree - I
Practical 11: Solution of differential equations of first order and first degree – II
Practical 12: Differential equations of first order and higher degree.

Note: There will be 4 lectures for each practical session per week.

Reference Books:

3) Analytical Solid Geometry by Shanti Narayan, S. Chand and Company Ltd, New Delhi, 1998.
4) A Text Book of Analytical Geometry of ThreeDimensions by P.K.Jain and Khalil Ahmad, Wiley Eastern Ltd., 1999.
5) Integral Calculus by Shanti Narayan and P.K. Mittal, S. Chand & Company Pvt. Ltd., 11^{th} Edition, 2005.
6) Elementary Differential Equations by Earl Rainville and Phillip Bedient, Collier Macmillan International Editions, 1969.
7) Ordinary and Partial Differential Equations by M.D. Raisinghania, S. Chand and Company, 2009.