# Anekant Education Society's
# Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

## Autonomous

## Course Structure for B.Sc. Mathematics

### F. Y. B. Sc. Mathematics

| Semester | Paper Code | Title of Paper | No. of Credits |
|---|---|---|---|
| I | MAT1101 | Algebra | 2 |
| | MAT1102 | Calculus-I | 2 |
| | MAT1103 | Practical Based on MAT1101 & MAT1102 | 2 |
| II | MAT1201 | Geometry | 2 |
| | MAT1202 | Calculus-II | 2 |
| | MAT1203 | Practical Based on MAT1201 & MAT1202 | 2 |

# SYLLABUS (CBCS) FOR F. Y. B. Sc. MATHEMATICS
## (w.e.f. June, 2019)

## Academic Year 2019-2020

**Class** : F.Y. B. Sc. (Semester- I)

# Paper Code: MAT1101

**Paper** : I          **Title of Paper :** Algebra

**Credit** : 2          **No. of lectures:** 36

**A) Learning Objectives:**
- Introduce the students with basic concepts in Mathematics such as sets, relations, equivalence relations and functions.
- To introduce different techniques of proving the theorems such as induction, proof by contradiction
- To introduce integers, complex numbers, and matrices as important examples to study different algebraic structures

**B) Learning Outcome:**
Use this algebraic structures & technique for further      learning    and     problem solving in Mathematics.

**TOPICS/CONTENTS:**

**Unit 01: Induction**                                             [*3 Lectures*]

     1.1 Well ordering principle for natural numbers

     1.2 Principle of Mathematical induction (Strong form)

**Unit 02: Sets, Relations and Functions**                      [*8 Lectures*]

     2.1 Definition of set, Operation on sets, Power set, Cartesian product of sets.

     2.2 Definition of relation, equivalence relation, equivalence classes, partition of a set.

     2.3 Definition of function, domain, co-domain, and the range of function, injective, surjective, bijective functions, composite functions, invertible functions.

## Unit 03: Integers                                    [*6 Lectures*]

3.1 Divisibility, Division algorithm, Euclidean algorithm, Properties of G.C.D. and L.C.M.

3.2 Primes, Euclid's lemma, Unique factorization theorem (Statement only).

3.3 Congruences: Definition and elementary properties, Fermat's little theorem (Statement only).

3.4 Euler's phi-function.

## Unit 04: Complex Numbers                             [*5 Lectures*]

4.1 Addition and multiplication of complex numbers, Modulus and amplitude of complex numbers, Real and imaginary parts and conjugate of complex numbers.

4.2 Geometric representation of sum, difference, product and quotient of two complex numbers as well as modulus, amplitude and conjugate.

4.3 De'Moivre's theorem, Roots of unity, Euler's formula.

## Unit 05: Matrices and system of linear equations     [*14 Lectures*]

5.1 Matrices, Row echelon and reduced row echelon form of a matrix, Rank of matrix.

5.2 System of linear equations, Matrix form of system of linear equations, Homogeneous and non-homogeneous system of linear equations, Gauss elimination, Gauss-Jordan methods.

5.3 Consistency of a system of linear equations, condition of consistency (Without proof).

5.4 Eigen values, Eigen vectors, Characteristic equation of a matrix.

5.5 Cayley Hamilton theorem (Statement only), Inverse of matrix.

**Textbook:**

1. David M. Burton, Elementary Number Theory, Tata McGraw Hill, 7$^{th}$ Edition, 2012. (**Sections:**1.1 , 2.1 to 2.4, 4.2, 5.2, 7.2, 7.3)

2. H. Anton,C. Rorres, Elementary linear algebra with applications, Wiley 7$^{th}$ Edition, 1994 (**Sections:**1.1 to 1.6, 6.1,9.1 to 9.3 )

3. Kenneth Rosen, Discrete Mathematics and its Applications, Tata McGraw Hill. (**Sections:** 2.1 to 2.3, 7.1 , 7.5)

**Reference Books:**

1. Tom M. Apostol, Calculus Volume – I, Wiley International Edition, 2007.

2. A Foundation Course in Mathematics , Ajit Kumar , S. Kumeareson , Bhaba Sarma

3. Robert G. Bartle, Donald R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 4$^{th}$ Edition, 2011.

4. Ruel V. Churchill, W. Brown, Complex Variables and Applications, Tata McGraw Hill, 9$^{th}$ Edition

**Class** : F.Y. B. Sc. (Semester- I)

# Paper Code: MAT1102

| | | |
|---|---|---|
| **Paper** | : II | **Title of Paper :** Calculus I |
| **Credit** | : 2 | **No. of lectures:** 36 |

**A) Learning Objectives:**
- To introduce concepts of limit, continuity, differentiation
- To understand the behavior of functions increasing, decreasing, concave up, concave down ,which is crucial in many practical situation

**B) Learning Outcome:**

To apply these concepts for advance study in Mathematics (Real Analysis, Complex Analysis, topology) & as tools or applications in physical, chemical, biological sciences.

**TOPICS/CONTENTS:**

**Unit 01: Introduction to Real Numbers:** [15 lectures]

1.1 The Set of Natural Numbers
1.2 The Set of Rational Numbers
1.3 The Set of Real Numbers
1.4 The Completeness Axiom
1.5 The symbols + and -

**Unit 02: Sequences** [18 lectures]

2.1 Limits of Sequences
2.2 A discussion about Proofs
2.3 Limit theorems for Sequences
2.4 Monotone Sequences and Cauchy Sequences
2.5 Subsequences
2.6 lim sup's and limit inf's

**Unit 03: Series** [3 lectures]

3.1 Introduction, Definition & examples , Partial Sums
3.2 Ratio Test (without proof)
3.3 Root Test (without proof)

**Text Book:**

Elementary Analysis (Second Edition), Kenneth A. Ross, Springer

**Sections:** 1 to 5, 7 to 12 &15

**Reference Books:**

1. A Course in Calculus and Analysis by Sudhir Ghorpade and BalmohanLimaye, Springer 2006.
2. Principles of Mathematical Analysis , W. Rudin, Third Edition, McGraw Hill, 1976
3. Mathematical Analysis , Tom M. Apostol.
4. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons,2002

**Class** : F.Y. B. Sc. (Semester- I)
**Paper Code:** MAT1103
**Paper** : III        **Title of Paper :** Practical Based on
                                            MAT1101 & MAT1102
**Credit** : 2           **No. of lectures:** 48

**A) Learning Objectives:**
      Improve problem solving ability in relations , functions , congruence
      Improve problem solving ability using properties of real numbers,sequences and series

**B) Learning Outcome:**
      Lead students to learning and improving their understanding of the Mathematics

**Title of Experiments:**

**Algebra:**

1. Induction and complex numbers.
2. Relations and functions.
3. Divisibility and congruences.
4. Matrices: Determinant, rank, Eigen values and Eigen vectors, Cayley Hamilton theorem.
5. System of linear equations
6. Miscellaneous

**Calculus I:**

1. Real Numbers
2. Graphs and functions with & without using software Maxima
3. Sequence -I
4. Sequence-II
5. Series
6. Miscellaneous

**Academic Year 2019-2020**

**Class** : F.Y. B. Sc. (Semester- II)
**Paper Code:MAT1201**
**Paper** : I          **Title of Paper :** Geometry
**Credit** : 2      **No. of lectures:** 36

**A) Learning Objectives:**
- Introduce the students with analytical geometry of 2 and 3 dimensions
- To study characteristics of 2 and 3 dimensional geometric shapes and mathematical results about their relationships

**B) Learning Outcome:**
Apply appropriate formulas and tools to determine measurements and use these techniques in real life context and other disciplines

**Unit 01: Analytical Geometry of two dimensions**        [*9 Lectures*]

- Locus of points, Change of axes (Translation and Rotation).
- General equation of second degree in $x$ and $y$, Centre of conic.
- Reduction to standard form: length of axes, equation of axes, foci, eccentricity, vertex, equation of directrix and latus rectum.
- General equation representing parabola.

**Unit 02: Planes in three dimensions**        [*9 Lectures*]

- Rectangular Cartesian coordinates of a point in space: Orientation of axes, Coordinates of a point, Direction cosines, Angle between two lines (using direction cosines).
- Equation of first degree in $x$, $y$, $z$, Normal form of the equation of a plane.
- Determination of a plane under given conditions.
- System of planes, Two sides of planes.
- Length of the perpendicular form a point to a plane, Bisectors of angles between two planes.
- Joint equation of two planes.

**Unit 03: Lines in three dimensions**        [*9 Lectures*]

- Equations of lines: In terms of direction cosines and a point on it, equations of lines though two points, Symmetrical and asymmetrical form of equations of line, Angle between the line and plane.

- The condition that a given line lie in a given plane, the condition that two lines are coplanar.
- Sets of conditions which determine a line.
- Skew lines, Shortest distance between two skew lines, length of perpendicular from a point to the line.

**Unit 04: The Sphere**                                                    [*9 Lectures*]

- Definition and equation of the sphere in various forms.
- Plane section of sphere, intersection of two sphere.
- Equation of a circle, sphere through a given circle, intersection of a sphere and a line.
- Equation of a tangent plane.

**Text Books:**

1. George Thomas, Ross Finney, Calculus and Analytical Geometry, Pearson Education (9$^{th}$ Edition)
   Chapter – 9
2. Shanti Narayan, Mittal, Analytical Solid Geometry, S. Chand and Company Ltd, 1998.
   Chapters – 1, 2, 3, 6.

**Reference Books:**

1. E. H. Askwyth, The Analytical Geometry of the conic section.
2. P. K. Jain, Khalil Ahmed, A text book of Analytical Geometry of three dimensions, Wiley Estern Ltd, 1999.
3. L. P. Eisenhart, Coordinate Geometry, The World Press Pvt. Ltd.
4. Gordan Fuller, Robert Parker, Analytical Geometry and Calculus, D. Van Nastrand.

**Class** : F.Y. B. Sc. (Semester- II)

**Paper Code:MAT1202**

**Paper** : II                    **Title of Paper :**Calculus II

**Credit** : 2        **No. of lectures:** 36

**A) Learning Objectives:**
- To introduce concepts of limit, continuity, differentiation
- To understand the behavior of functions increasing, decreasing, concave up, concave down ,which is crucial in many practical situation

**B) Learning Outcome:**

To apply these concepts for advance study in Mathematics (Real Analysis, Complex Analysis, topology) & as tools or applications in physical, chemical, biological sciences.

**Unit 1. Continuous Functions:**[*18 Lectures*]

i) Continuous Functions

ii) Properties of Continuous Functions

iii) Uniform Continuity

iv) Limits of funtions

**Unit 2.Differentiation:**[*18 Lectures*]

i) Basic properties of the Derivative

ii) The Mean Value Theorem

iii) L'Hospital Rules

iv) Successive Differentiation , Leibnitz theorem

iv) Taylor's Theorem& Maclaurin's Series

**Text Book:**Elementary Analysis (Second Edition), Kenneth A. Ross, Springer

Sections: 17 to 20, 28 to 31

**Reference Books:**

1. A Course in Calculus and Analysis by SudhirGhorpade and BalmohanLimaye, Springer 2006.

2. Principles of Mathematical Analysis , W. Rudin, Third Edition, McGraw Hill, 1976

3.Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons,2002

4. Mathematical Analysis , Tom M. Apostol.

**Class**      **:** F.Y. B. Sc. (Semester- II)
**Paper Code:MAT1203**
**Paper**     **:** III     **Title of Paper :**Practical based on MAT1201 &
MAT1202
**Credit**    **:** 2       **No. of lectures:** 48


## A) Learning Objectives:
- Problem solving in 2 and 3 dimensional analytical geometry
- Problem solving in continuity and differentiation and use them to study characteristics of functions

## B) Learning Outcome:
Improving problem solving skill of students

**Title of Experiments**

Geometry:

1. Analytical geometry in 2 dimensions I
2. Analytical geometry in 2 dimensions II
3. Planes in 3 dimensions
4. Lines in 3 dimensions
5. Sphere
6. Geometry using Maxima software
7. Miscellaneous


Calculus II:

1. Continuous functions I
2. Continuous functions II
3. Differentiation I
4. Differentiation II
5. Taylor's Series
6. Calculus using Maxima software
7. Miscellaneous