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# FIRST-YEAR OF BACHELOR OF SCIENCE MAJOR MATHEMATICS REVISED SYLLABUS ACCORDING TO CBCS NEP2020

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COURSE TITLE: ALGEBRA I SEMESTER-I, W.E.F. 2023-2024

**RECOMMENDED BY THE BOARD OF STUDIES IN MATHEMATICS  
AND**

**APPROVED BY THE ACADEMIC COUNCIL**

Devrukh Shikshan Prasarak Mandal's

Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and  
Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh.  
Tal.Sangmeshwar, Dist. Ratnagiri-415804, Maharashtra, India

Academic Council Item No: \_\_\_\_\_

Name of the Implementing Institute	:	Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal. Sangmeshwar, Dist. Ratnagiri-415804,
Name of the Parent University	:	University of Mumbai
Name of the Programme	:	Bachelor of Science
Name of the Department	:	Mathematics
Name of the Class	:	First Year
Semester	:	First
No. of Credits	:	04
Title of the Course	:	Algebra-I
Course Code	:	S102MTT
Name of the Vertical in adherence to NEP 2020	:	Major and Minor
Eligibility for Admission	:	Any 12 <sup>th</sup> Pass seeking Admission to Degree Programme in adherence to Rules and Regulations of the University of Mumbai and Government of Maharashtra
Passing Marks	:	40%
Mode of Assessment	:	Formative and Summative
Level	:	UG
Pattern of Marks Distribution for TE and CIA	:	60:40
Status	:	NEP-CBCS
To be implemented from Academic Year	:	2023-2024
Ordinances /Regulations (if any)		

## Syllabus for First Year of Bachelor of Science in Mathematics

(With effect from the academic year 2023-2024)

**SEMESTER-I**

**Paper No.– Mathematics Paper – II**

**Course Title: Mathematics**

**No. of Credits - 02**

**Type of Vertical: Major and Minor**

**COURSE CODE: S102MTT**

**Learning Outcomes Based on BLOOM's Taxonomy:**

After completing the course, the learner will be able to...

Course Learning Outcome No.	Blooms Taxonomy	Course Learning Outcome
CLO-01	Remember	Remember the fundamental Properties of divisibility of integers, congruences.
CLO-02	Understand	Understand basic concepts of GCD, LCM, functions relations and polynomials
CLO-03	Apply	Apply the Euler's theorem, Fermat's theorem and Wilson theorem
CLO-04	Analyze	Analyze the divisibility properties integers, functions, relations and Polynomials.

## Syllabus for First Year of Bachelor of Science in Mathematics

(With effect from the academic year 2023-2024)

**SEMESTER-I**

**Paper No.– Mathematics Paper – II**

**Course Title: ALGEBRA- I**

**No. of Credits - 02**

**Type of Vertical: Major and Minor**

**COURSE CODE: S102MTT**

Module No.	Content	No. of Lectures
<b>1</b> <b>Integers &amp; Divisibility</b>	<p>1. Statements of Well-ordering property of non-negative integers, Principle of mathematical induction (first and second) as a consequence of well- ordering property. Binomial theorem for non-negative exponents, Pascal Triangle.</p> <p>2. Divisibility in integers, division algorithm, greatest common divisor (g.c.d.) and least common multiple (l.c.m.) of two integers, basic properties of g.c.d. Such as existence and uniqueness of g.c.d. of integers <math>a</math> &amp; <math>b</math> and that the g.c.d. can be expressed as <math>ma + nb</math> for some <math>m, n \in \mathbb{Z}</math>, Euclidean algorithm, Primes, Euclid's lemma. Fundamental Theorem of arithmetic, The set of primes is infinite</p> <p>3. Congruence, definition and elementary properties, Euler's <math>\varphi</math> function, statements of Euler's theorem, Fermat's theorem and Wilson theorem, Applicatios.</p>	10
<b>2</b> <b>Functions and Equivalence relations</b>	<p>1. Definition of function, domain, co-domain and range of a function, composite functions, examples, direct image <math>f(A)</math> and inverse image <math>f^{-1}(B)</math> for a function <math>f</math>, injective, surjective, bijective functions, Composite of injective, surjective, bijective functions when defined, invertible functions, bijective functions are invertible and conversely, examples of functions including constant, identity, projection, inclusion, Binary operation as a function, properties, examples.</p> <p>2. Equivalence relation, Equivalence classes, properties such as two equivalence classes are either identical or disjoint, definition of partition, every partition gives an equivalence relation and vice versa.</p> <p>3. Congruence is an equivalence relation on <math>\mathbb{Z}</math>, Addition modulo <math>n</math>, Multiplication modulo <math>n</math>, examples.</p>	10
<b>3</b>	1. Definition of a polynomial, polynomials over the field where $= \mathbb{Q}$ ,	10

<b>Polynomials</b>	$\mathbb{R}$ or $\mathbb{C}$ , Algebra of polynomials, degree of polynomial, basic properties.  2. Division algorithm in $[ ]$ (without proof), and g.c.d of two polynomials and its basic properties (without proof), Euclidean algorithm (without proof), applications, Roots of a polynomial, relation between roots and coefficients, multiplicity of a root, Remainder theorem, Factor theorem.  3. A polynomial of degree $n$ over $\mathbb{R}$ has at most $n$ roots, Complex roots of a polynomial in $\mathbb{R}[x]$ occur in conjugate pairs, Statement of Fundamental Theorem of Algebra, A polynomial of degree $n$ in $\mathbb{C}[x]$ , has exactly $n$ complex roots counted with multiplicity, A non-constant polynomial in $\mathbb{R}[x]$ can be expressed as a product of linear and quadratic factors in $\mathbb{R}[x]$ , necessary condition for a rational number to be a root of a polynomial with integer coefficients, simple consequences such as $\sqrt{2}$ is an irrational number where $p$ is a prime number, roots of unity, sum of all the roots of unity.	
	Total	30

### Required Previous Knowledge

Basic Knowledge of fundamentals of Mathematics is necessary to learn the course.

### Access to the Course

The course is available for all the students admitted for Bachelor of Science as a Major or a minor. The students seeking admission in other disciplines may select the course as a minor considering the terms and conditions laid down by the University of Mumbai, the Government of Maharashtra, and the college, from time to time.

### Forms of Assessment

The assessment of the course will be of Diagnostic, Formative and Summative type. At the beginning of the course diagnostic assessment will be carried out. The formative assessment will be used for the Continuous Internal Evaluation whereas the summative assessment will be conducted at the end of the term. The weightage for formative and summative assessment will be 60:40. The detailed pattern is as given below.

**Term End Evaluation (30 Marks)**

**Question Paper Pattern**

**Time: 1 hour**

<b>Question No.</b>	<b>Question Pattern</b>	<b>Marks</b>
Q.1	Short Answer Questions (based on Unit I)	10
Q.2	Long Answer Questions (based on Unit II)	10
Q.3	Long Answer Questions (based on Unit III)	10
<b>Total</b>		<b>30</b>

**Internal evaluation (20 Marks)**

<b>Sr. No.</b>	<b>Description</b>	<b>Marks</b>
1	Mid Term Examination	10
2	Active Participation in teaching learning Process	05
3	Subject related activities as assigned by the teacher	05
<b>Total</b>		<b>20</b>

**Grading Scale**

The grading scale used is O to F. Grade O is the highest passing grade on the grading scale, and grade F is a fail. The Board of Examinations of the college reserves the right to change the grading scale.

## References:

### Reference Books

1. David M. Burton, Elementary Number Theory, Seventh Edition, McGraw Hill Education (India) Private Ltd.
2. Norman L. Biggs, Discrete Maths
3. R. G. Bartle- D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.
4. Serge Lang, Introduction to Linear Algebra, Second edition Springer.
5. S. Kumaresan, Linear Algebra, Prentice Hall of India Pvt limited
6. K. Hoffmann and R. Kunze Linear Algebra, Tata MacGraw Hill, New Delhi, 1971
7. Gilbert Strang, Linear Algebra and its Applications, International Student Edition.
8. L. Smith, Linear Algebra, Springer Verlag
9. A. Ramchandran Rao, P. Bhimashankaran; Linear Algebra Tata Mac Graw Hill.