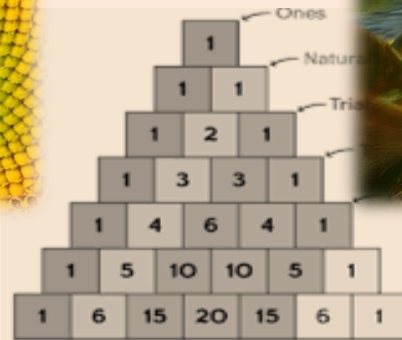
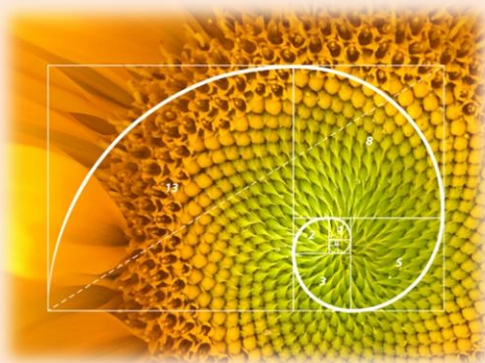


Add-On Course

On

Beauty of Number System



Department of Mathematics

Silda Chandrasekhar College

2023 – 24

Beauty of Numbers

I. Basic Details of the course

1. **Course Title** : **Beauty of Number System**

2. **Context** : Number theory is a branch of mathematics that deals with the properties and relationships of numbers, particularly integers. It explores patterns, structures, and properties of numbers and seeks to understand their fundamental properties and behaviours. Number theory has wide applications in our daily life such as cryptography, computer science, and physics, and it plays a foundational role in many areas of mathematics.

3. **Prerequisite** : Basic knowledge of Mathematics

4. **Course Objective:** i) To develop proper understanding of number system.

ii) To develop an intelligent proficiency in its fundamental process.

iii) To teach the learner mathematical type of thought, to understand the statement to analyze them and to arrive at right conclusions.

iv) To develop the interest in the quantitative side of the world and its use as a simple tool in practical life.

v) To aid the students to familiar with the historical background of numeric system.

vi) To impart a working knowledge of practical arithmetical applications which are useful in life.

vii) To perform calculations faster and more accurately.

viii) To manage their time better in competitive exams by simplifying calculations.

ix) To develop confidence in mathematical abilities.

x) To improve the focus, memory, and concentration of the students.

5. Programme Highlights and Unique Features: The syllabus starts with origin and development of number system. Then it develops gradually the fundamental conception of number system among the students. It covers arithmetic operations, congruence of numbers, some interesting real life applications and cryptography.

6. Career Prospect: Number Theory is a branch of pure mathematics. Individuals with expertise in this field can

i) help to prepare for competitive examinations like banking sector, railway service, WBCS, PSC, SSC, UPSC etc.



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ii) develop new theories, and contribute to mathematical advancements.

iii) pursue career in modern Data Encryption Techniques. Concepts such as prime numbers, modular arithmetic, and discrete mathematics are the ones underlying billions of cryptographic encryption and decryption methods.

iv) pursue careers in research and academia

- 7. Faculty Requirement:** 2 Teachers
- 8. Course Fee:** Nil
- 9. Target Students:** Any student of the college
- 10. Intake Capacity:** 100
- 11. Contact Hours:** 30 hours

12. Course Outcome: After completing an add-on course in number theory, students will be able to:

- i. Know the evolution of number theory
- ii. Learn easy computational techniques of Vedic mathematics
- iii. Find remainders and quotients from integer division
- iv. Apply Euclid's algorithm and backwards substitution
- v. Understand the definitions of residue classes, least residues, and congruences
- vi. Add, subtract, multiply, and calculate powers of integers modulo n
- vii. Determine multiplicative inverses modulo n and use them to solve linear congruences
- viii. Know the real life applications of number theory as well as its amazing applications in nature.
- ix. Gain knowledge in cryptography

13. Course Co-ordinator: Dr. Nirmal Kumar Mandal, Associate Professor, Dept
of Mathematics

II. Curriculum Structure of the Add-On Course

| Unit | Title | Hours | No of lectures |
|--------------|---|-----------|----------------|
| 1 | Origin and development of number system | 4 | 4 |
| 2 | Classification of number system | 6 | 6 |
| 3 | Basic operations on Vedic mathematics | 6 | 6 |
| 4 | Congruence of numbers | 6 | 6 |
| 5 | Some special types of numbers with real life applications | 6 | 6 |
| 6 | Cryptography | 2 | 2 |
| Total | | 30 | 30 |

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III. Detailed Curriculum of the Course

Unit – 1: Origin and development of number system [4 Lectures]

Sumerian and Babylonian number system, Roman numeral system, Hindu-Arabic numeral system, Chinese number system.

Unit – 2: Classification of number system [6 Lectures]

Natural numbers, integers, rational numbers, Irrational numbers, prime numbers, real numbers, complex numbers and their geometrical representation. Binary number system, Decimal number system and their conversion.

Unit – 3: Basic operations on Vedic mathematics [6 Lectures]

Addition, subtraction, multiplication and division. Division algorithm, square of a number, greatest common divisor (GCD), least common multiplier (LCM), Euclidean algorithm, Sieve of Eratosthenes.

Unit – 4: Congruence of numbers [6 Lectures]

Definition, basic properties and examples. Application to find the day of a date, unit digit of a number, remainder of a number when divided by an integer.

Unit – 5: Some special types of numbers with real life applications [6 Lectures]

Pythagorean number, Palindrome number, Fibonacci number, Golden ratio and their real life applications.

Unit – 6: Cryptography [2 Lectures]

Caesar cipher, Public Key cryptography.

IV. Lesson Plan of the Course

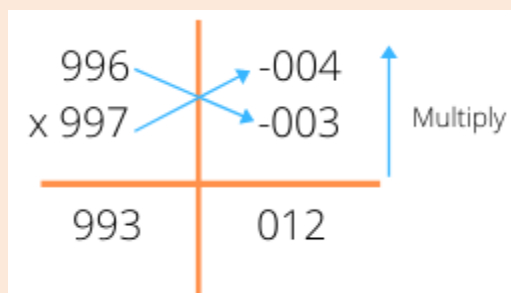
| Lectures (1 Lecture = 1 hour) | Content |
|----------------------------------|--|
| 1 | Sumerian and Babylonian number system |
| 2 | Roman numeral system |
| 3 | Hindu-Arabic numeral system |
| 4 | Chinese number system |
| 5 | Natural numbers, integers, rational, Irrational numbers and their properties |
| 6 | Prime numbers and their properties |
| 7 | Binary and decimal number system and their conversion |
| 8 | Addition, subtraction and multiplication of numbers |
| 9 | Division by integers |
| 10 | Division algorithm |

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| | |
|-------|---|
| 11 | Square of a number |
| 12 | Cube of a number |
| 13 | GCD of numbers and their applications |
| 14 | LCM of numbers and their applications |
| 15 | Euclidean algorithm and its applications |
| 16 | Seive of Eratosthenes |
| 17 | Basic concept on congruence |
| 18-19 | Basic properties of congruence |
| 20-24 | Application of congruence |
| 25 | Pythagorean number |
| 26 | Palindrome number |
| 27 | Fibonacci numbers |
| 28 | Golden ratio and their real life applications |
| 29 | Caesar cipher cryptography |
| 30 | Public key cryptography |

V. Evaluation Policy

- Total Marks: 50
- Theory Examination (Objective Type): 30
- Group Discussion: 15
- Attendance: 5
- Pass Marks: 25



VI. Gradation System

| Marks Obtained | Grade |
|----------------|-------|
| 45 – 50 | A + |
| 40 – 44 | A |
| 35 – 39 | B + |
| 30 – 34 | B |
| 25 – 29 | C |
| Below 25 | Fail |

VII. Certification

Students will be awarded by a certificate after the successful completion of the course.

VII. Learning Resources

1. The Book of numbers, Shakuntala Devi. Orient Paperbacks.
https://badarayana.org/upload/pdf/the_book_of_numbers.pdf

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2. The Real Number System, John M H Olmsted, University of Florida Libraries.
<https://ia601906.us.archive.org/14/items/realnumbersystem00olms/realnumbersystem00olms.pdf>
3. Elementary Number Theory, David M Burton, McGraw Hill Education (India) Private Ltd.
https://undergraduatemaths.wordpress.com/wp-content/uploads/2017/12/david_m_burton_elementary_number_theory_seventbook4you.pdf
4. <https://www.nios.ac.in/media/documents/SecMathcour/Eng/Chapter-1.pdf>
5. On the History of Indian Mathematics, SATYAANSHU, N. SHIVAKUMAR, *INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH* Volume No.3, Issue No.2, February – March 2015, 1915 – 1924.
6. The History of Mathematics, David M Burton, McGraw Hill Private Ltd.
<https://jontalle.web.engr.illinois.edu/uploads/298/HistoryMath-Burton.85.pdf>
7. Fibonacci Numbers and the Golden Ratio. <https://www.math.hkust.edu.hk/~machas/fibonacci.pdf>

$$\begin{array}{r} \text{[3} \times \text{4} = \text{12]} \\ \text{'one more'} \\ \text{32} \times \text{38} = \text{12 16} \\ \text{[2} \times \text{8} = \text{16]} \\ \text{same digit} \quad \text{[2} + \text{8} = \text{10]} \end{array}$$



$$\text{Unit digit of } 54673^{76498} + 2196^{7853} = ?$$

