

Subject Code: 02MA0454
Subject Name: NUMBER THEORY
M.Sc. Year – I (Sem-II)

Objective: The main aim is to make students familiar with theory of numbers and their special structures.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, student will be able to

- Solve problems involving Divisibility, The Greatest Common divisor, Euclidean Algorithm and Fundamental Theorem of Arithmetic.
- Use theory of Congruences to solve problems.
- Use basic Number Theoretic Functions to solve the problems.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	2	-	5	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	<u>Divisibility Theory, Prime distribution:</u> Division algorithm, Greatest common divisor, The Euclidean algorithm, The Diophantine Equation $ax + by = c$, Properties of primes, Fundamental Theorem of Arithmetic, Euclid's Theorem, Distribution of primes.	12
2	<u>The theory of congruences:</u> Basic Properties, Special divisibility tests, Linear congruences and their Solution, Chinese Remainder theorem, Fermat's little theorem, Wilson's theorem and its Applications.	12
3	<u>The number theoretic functions:</u> The functions τ and σ , The greatest integer function, Möbius inversion formula, Euler's Phi function, Euler's theorem, Some properties of Phi function.	12

4	<u>Primitive roots and indices:</u> The order of an integer modulo n , Primitive roots of primes, Lagrange's Theorem, Composite numbers having primitive roots, The theory of indices.	12
5	<u>Quadratic congruences:</u> Euler's criterion, The Legendre's symbol, Gauss's Lemma, Quadratic reciprocity Law, Quadratic congruences with composite moduli.	12
	Total Hours	60

Recommended Books:

1. Ivan Niven, H. S. Zuckerman, H.L.Montgomery: "An introduction to the Theory of Numbers (5th edition) by (John Wiley & Sons Inc.), 1991
2. David M. Burton: Elementary Number theory (seventh edition) by, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2010
3. Alan Baker: A Concise introduction to the Theory of Numbers by (Cambridge Uni. Press, Cambridge), 1984
4. An introduction to the theory of numbers by G.H.Hardy and E.M.Wright, oxford University press, London, 1975(Latest print)
5. Advanced number theory, Harvey Cohn, Dover publication Inc. Newyork,1962.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Instructional Method:

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1. https://en.wikipedia.org/wiki/Number_theory
2. <https://www.britannica.com/topic/number-theory>
3. <http://mathworld.wolfram.com/topics/NumberTheory.html>