Bachelors with Mathematics as Major

4th Semester

MMT422J3: Mathematics/Applied Mathematics: Theory of Numbers

Credits: 4 THEORY + 2 TUTORIAL **Theory: 60 Hours & Tutorial: 30 Hours**

Course Objectives: To enlighten students about the extensive study of integers, prime numbers and their properiteis (ii) to understand number theoretic functions and their applications.

Course Outcome: Upon successful completion of this course students will able to

(i) deal with the problems arising in cryptography and information theory especially in RSA encryption and decryption.

(ii) solve congruences, linear diaphatine equations, and other higher concepts of Discrete Mathematics.

Theory: 4 Credits

Unit –I

Divisibility of integers, prime numbers, fundamental theorem of arithmetic's, sequence of primes, Goldbach conjecture, Euclid's division algorithm, GCD and LCM of integers and their properties, Euclid's first theorem.

Unit –II

Linear Diophantine equations. Necessary and sufficient condition for solvability of linear Diophantine equations, Positive solutions. Linear Congruence's, solutions and applications, Euclid's Second theorem, Fermat Numbers and their properties.

Unit –III

Complete Residue System (*CRS*), Reduced Residue System (*RRS*) and their properties. Fermat and Euler's theorems with applications. Number theoretic functions, Euler's ϕ-function, $\phi(mn) = \phi(m)\phi(n)$ where $(m, n) = 1$, $\Sigma\phi(d) = n$, $\phi(m) = m\prod(1-\frac{1}{p})$ for $m > 1$. Chinese Remainder theorem with applications.

Unit –IV

Order of an integer modulo *n,* primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol, law of reciprocity and its applications, Fermat's Last Theorem (statements only).

Tutorial: 2 Credits

Unit –V

Theory of polynomial equations, fundamental theorem of algebra, Remainder theorem and factor theorems, complex roots of a polynomial and their properties, synthetic division, relation between roots and coefficients.

Unit –VI

Solution of cubic and biquadratic polynomial equations. Problems on symmetric functions, Cardon's method and Descarte's rule of signs.

Recommended Books:

1. G.H Hardy and E.M. Wright, An introduction to the theory of Numbers, Fifth Edition, Oxford Science Publications,1980.
2. E. Landau, Elementary Number Theory, American Mathematical Society, 2nd Edition, 1999.
3. W. J. Leveque, Topics in Number Theory, Vol(I & II), Dover Publishers, 2002
4. Ivan Niven and H.S Zuckerman, An introduction of the Theory of Numbers, John Wiley & Sons, 1991
5. Thomas Koshy, Elementary Number Theory with Applications (2 nd Edition), Academic Press, 2007.
6. Aziz and Nisar, Theory of Equations, Kapoor and Son's, Srinagar, 2011
7. C.C.MacDuffee, Theory of Equations, John Wiley and Sons Inc., 1954.