

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NMCD541	Coding Theory	3	0	0	3

Course Objective

Coding Theory plays an important role in Computer science and Electrical Communications as well as in mathematics itself. Consequently, it becomes more and more desirable to introduce the student to the Error correction codes at an early stage of study.

Learning Outcomes

Coding Theory is an abstract branch of mathematics, Electrical communications and computer Science that originated from Linear Algebra. The main outcome of this course is to develop the capacity of encoding, decoding and idea of communications theory and Information theory.

Unit No.	Topicsto beCovered	Lecture Hours	LearningOutcome
1	Binary Hamming codes, dual of a code, constructing codes by various operations, simplex codes, Hadamard matrices and codes constructed from Hadamard and conference matrices, Plotkin bound and various other bounds, Gilbert-Varshamov bound.	8	The main outcome of this course is to develop the idea of Hamming codes, codes construction from Hadamard matrices and Plotkin bounds.
2	Reed-Muller and related codes: First order Reed-Muller codes, RM code of order r , Decoding and Encoding using the algebra of finite field with characteristic two. Perfect codes.	8	The main outcome of this unit to study the Reed-Muller codes of different orders and their encoding and decoding algorithm
3	Weight enumerators, Kratchouwk polynomials, Lloyd theorem, Binary and ternary Golay codes, connections with Steiner systems. Cyclic codes: The generator and the check polynomial, zeros of a cyclic code, the idempotent generators, BCH codes, Reed-Solomon codes, Quadratic Residues codes, generalized RM codes	8	The main outcome of this unit is develop the idea of cyclic codes, Reed-Soloman codes, BCH Codes and their applications
4	Codes over Z_4 : Quaternary codes over Z_4 , binary codes derived from such codes, Galois rings over Z_4 , cyclic codes over Z_4 .	8	The outcome of this unit is to develop the idea of construction of different kind of codes over Z_4
5	Goppa codes: the minimum distance of Goppa codes, generalized BCH codes, decoding of Goppa codes and their asymptotic behavior. Algebraic geometry codes: algebraic curves and codes derived from them, Riemann-Roch theorem (statement only) and applications to algebraic geometry codes.	10	The outcome of this unit is to understand the algebraic geometric codes.
Total		42	

TextBooks:

1. J.H. van Lint, Introduction to Coding Theory, Springer, 1999.
2. W.C. Huffman and V. Pless, Fundamentals of Error Correcting Codes, Cambridge University Press, 2003.

ReferenceBooks:

1. J. MacWilliams and N.J.A. Sloane, The Theory of Error Correcting Codes, North Holland, 1977.
2. S. Ling and C. Xing, Coding Theory: A First Course, Cambridge University Press, 2004.