

Course Code		Course Title	Error Correcting Codes			
Dept./Faculty proposing the course	Dr R Sri Prakash	Structure (LTPC)	L	T	P	C
			3	1	0	4
To be offered for	UG/PG	Type	Core ☐		Elective ☒	
		Status	New ☒		Modification ☐	
Pre-requisite	Probability theory	Submitted for approval				
Learning Objectives	- Understand the principles of error detection and correction and their importance in reliable data transmission and storage. - Construct and analyze linear, cyclic, and algebraic codes using finite field and matrix methods. - Implement and evaluate decoding algorithms (e.g., Berlekamp- Massey, Viterbi) to assess code performance and error-correcting capability.					
Learning Outcomes	- Explain the theory and mathematical foundations of error detection and correction techniques used in digital communication systems. Design and encode various error-correcting codes such as linear, cyclic, BCH, and Reed-Solomon codes for reliable data transmission. - Apply and compare decoding algorithms to evaluate the performance and efficiency of different coding schemes.					
Contents of the course (With approximate break-up of hours for L/T/P)	Linear block codes- Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the MacWilliams identities; Perfect codes (L9+T3) Finite Fields and Cyclic Codes- Introduction to finite fields and finite rings; factorization of (X^n-1) over a finite field; Cyclic Codes; BCH codes; Idempotents and Mattson-Solomon polynomials (L9+T3) Advanced Algebraic Codes- Reed-Solomon codes, Justesen codes, MDS codes, Alterant, Goppa, and generalized BCH codes; Spectral properties of cyclic codes (L8+T3) Decoding Algorithms- Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique, and its relation to Berlekamp's algorithm. A fast Berlekamp-Massey algorithm; Convolution codes (L10+T3) Sequential Decoding- Wozencraft's sequential decoding algorithm, Fann's algorithm, and other sequential decoding algorithms (L6+T2)					
Text Books	- Lin, Shu, and Daniel J. Costello. Error control coding. Vol. 2. Englewood Cliffs: Prentice Hall, ISBN- 0130426725, 2004. - Blahut, Richard E. Algebraic codes for data transmission. Cambridge university press, ISBN-0521556597, 2003.					
Reference Books	Richardson, Tom, and Ruediger Urbanke. <i>Modern coding theory</i>. Cambridge university press, ISBN-9780521852296, 2008. Roth, <i>Introduction to Coding Theory</i>, Cambridge Univ. Press 2012. ISBN- 9780511808968, 2012.					