Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE92X	Error Correction Code	4	--	--	4	--	--	4
		Examination Scheme						
		Theory Marks						
		ISE			MSE		ESE	
		10			30		100 (60% Weightage)	

Pre-requisite Course Codes		Digital Communication
After successful completion of the course students will able to:		
Course Outcomes	CO1	Apply Galois field theory to Error correction codes
	CO2	Design methodology of Error correction codes for wired/wireless communication systems
	CO3	Analyzing algorithms for Error correction codes
	CO4	Improving depth of Concepts through case studies

Module No.	Unit No.	Topics	Ref.	Hr.
1		**Introduction to Algebra:** Groups, Fields, Binary Field Arithmetic, Construction of Galois Field GF (2m) and its basic properties, Computation using Galois Field GF (2m) Arithmetic, Vector spaces and Matrices**.**		8
2		**Linear Codes:** Block codes: Generator and Parity check Matrices, Encoding circuits, Syndrome and Error Detection, Minimum Distance Considerations, Error detecting and Error correcting capabilities, Standard array and Syndrome decoding, Decoding circuits, Hamming Codes, Reed – Muller codes, Golay code, Product codes and Interleaved codes. Cyclic Codes: Introduction, Generator and Parity check Polynomials, Encoding using Multiplication circuits, Systematic Cyclic codes – Encoding using Feedback shift register circuits, Generator matrix for Cyclic codes, Syndrome computation and Error detection, Meggitt decoder, Error trapping decoding, Cyclic Hamming codes, Golay code, Shortened cyclic codes.		10
3		**BCH Codes** Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction. Non – binary BCH codes: q – ary Linear Block Codes, Primitive BCH codes over GF (q), Reed – Solomon Codes, Decoding of Non – Binary BCH and RS codes: The Berlekamp - Massey Algorithm.		10
4		**Convolutional Codes:** Encoding of Convolutional codes, Structural properties, Distance		10

		properties, Viterbi Decoding Algorithm for decoding, Soft – output Viterbi Algorithm, Stack and Fano sequential decoding Algorithms, Majority logic decoding.		
5		**Concatenated Codes and Turbo Codes:** Single level Concatenated codes, Multilevel Concatenated codes, Soft decision Multistage decoding, Concatenated coding schemes with Convolutional Inner codes, Introduction to Turbo coding and their distance properties, Design of Turbo codes		10
6		**Applications:** Case studies of ECC related to various wired and wireless Communication Networks, Neural Networks, DVB and DAB, Cognitive Radio		10
			Total	48

References:

[1] Shu Lin & Daniel J. Costello, Jr. "Error Control Coding" Prentice Hall, Second Edition, 2004.
[2] S. B Wicker, Error Control Systems for Digital Communication and Storage, Prentice Hall International, 1995.
[3] Blahut R. E, Theory and Practise of Error Control Codes, Addisson Wesley, 1983
[4] Blahut R.E., Algebraic codes for Data transmission, Cambridge University Press, 2003