Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC601	Digital Communication	4	-	--	4	-	--	4
		Examination Scheme						
		ISE	MSE		ESE			
		10	30		100 (60% Weightage)			

Pre-requisite Course Codes	ETC405 Signal and System, ETC502 Analog Communication, ETC503 Random Signal Analysis
After successful completion of the course, student will be able to	
Course Outcomes	CO1	Ability to model various entities of digital communication system mathematically
	CO2	Identify and analyse methods of various digital communication sub-blocks and compare their performance.
	CO3	Ability to Perform the time and frequency domain analysis of the signals in a digital communication system.
	CO4	Explain receiver techniques for detection of a signal in AWGN channels.
	CO5	Provide sound evaluation of digital communication applications in terms of their performance

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Information theory and source coding**	1,2,3	06
	1.1	Block diagram and sub-system description of a digital communication system,measure of information and properties, entropy and it's properties		
	1.2	Source Coding, Shannon's Source Coding Theorem, Shannon-Fano Source Coding,Huffman Source Coding		
	1.3	Differential Entropy, joint and conditional entropy, mutual information and channel capacity, channel coding theorem, channel capacity theorem		
2		**Baseband Modulation and Transmission**	2,4	06
	2.1	Discrete PAM signals and it's power spectra		
	2.2	Inter-symbol interference, Nyquist criterion for zero ISI, sinusoidal roll-off filtering, correlative coding, equalizers, and eye pattern		
3		**Base band Detection**	2,4	05
	3.1	Orthogonality, representation of signals		
	3.2	Maximum likelihood decoding		
	3.3	Correlation receiver, equivalence with matched filter		
4		**Bandpass Modulation and Demodulation**	1,2,4	12

	4.1	Bandpass digital transmitter and receiver model, digital modulation schemes		
	4.2	**Generation, detection, signal space diagram, spectrum, bandwidth efficiency, and probability of error analysis of:** Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK)Modulations, Binary Phase Shift Keying (BPSK) Modulation, Quaternary Phase Shift Keying QPSK), Mary PSK Modulations, Quadrature Amplitude Modulation (QAM), Minimum Shift Keying (MSK)		
	4.3	Comparison between bandwidth and bit rate, applications of digital modulation schemes		
5	**Error Control Systems**		2,5	17
	5.1	Types of error control, error control codes, linear block codes, vector spaces ,vector sub spaces, generator matrix, systematic linear block codes, parity check matrix, syndrome testing ,error correction, and decoder implementation.		
	5.2	**Cyclic codes:** Algebraic structure of cyclic codes, binary cyclic code properties, encoding in systematic form, circuits for dividing polynomials, systematic encoding with shift register and error detection.		
	5.3	**Convolution Codes:** Time domain and transform domain approach, graphical representation, code tree, trellis, state diagram, decoding methods, maximum likelihood decoding, and free distance		
	5.4	Viterbi decoding, hard decision Viterbi decoding , decoding window, soft decision Viterbi decoding, code spectra, recursive systematic codes, code transfer function,and application areas		
6	**Spread Spectrum**		2,5,6	06
	6.1	Spread Spectrum (SS) concept, PN Sequences, Direct Sequence(DS), Frequency Hopping (FH), and Time Hopping		
	6.2	Comparison of Spread Spectrum Methods, SS Communication System, DSSS with Coherent BPSK, Processing Gain, Probability of Error of FHSS Transmitter and FHSS Receiver.		
			Total	**52**

References
1. Sklar B, and Ray P. K., *"Digital Communication: Fundamentals and applications,"* Pearson, Dorling Kindersley (India), Delhi, Second Edition, 2009.
2. Haykin Simon, *"Digital Communication Systems,"* John Wiley and Sons, New Delhi, Forth Edition, 2014.
3. H. Taub, D. Schlling, and G. Saha, "*Principles of Communication Systems,*" Tata Mc- Graw Hill, New Delhi, Third Edition, 2012.
4. Lathi B P, and Ding Z., "*Modern Digital and Analog Communication Systems,*" Oxford University Press, Forth Edition, 2009.
5. T L Singal, "*Analog and Digital Communication,*" Tata Mc-Graw Hill, New Delhi, First Edition, 2012.
6. P Ramakrishna Rao, *"Digital Communication,"* Tata Mc-Graw Hill, New Delhi, 1e.