

Unit I

Chapter 1 : Random Processes & Noise 1-1 to 1-40

Syllabus : Random processes : Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation and Covariance function, Ergodic processes, Transmission of a random process through a LTI filter, Power spectral density. **Mathematical representation of Noise :** Some sources of noise, Frequency domain representation of noise, Superposition of noises, Linear filtering of noise, Quadrature components of noise, Representation of noise using orthonormal coordinates.

1.1	Introduction	1-2
1.1.1	Properties of Random Signals	1-2
1.2	Random Process or Stochastic Process	1-2
1.2.1	Sample Functions	1-2
1.2.2	Ensemble	1-3
1.2.3	Definition of Random Process	1-3
1.2.4	Relation between a Random Variable and a Random Process	1-3
1.2.5	Ensemble Mean or Ensemble Average	1-4
1.2.6	Time Averages	1-4
1.2.7	Classification of Random Processes	1-5
1.2.8	Characteristics of a Random Processes	1-5
1.3	Stationary and Non-stationary Random Processes	1-5
1.3.1	Definition of a Strictly Stationary Process	1-6
1.3.2	Jointly Stationary Process	1-6
1.3.3	Properties of Strictly Stationary Process	1-6
1.4	Mean, Correlation and Covariance Functions of a Stationary Random Process	1-7
1.4.1	Mean of a Stationary Random Process	1-7
1.4.2	Autocorrelation of Process X (t)	1-7
1.4.3	Auto-covariance Function of a Stationary Process	1-8
1.4.4	Wide Sensed Stationary Process	1-8
1.5	Autocorrelation Function of a Random Process	1-8
1.5.1	Properties of Autocorrelation Function	1-9
1.5.2	Significance of Autocorrelation Function	1-9
1.6	Cross Correlation Functions	1-13
1.6.1	Properties of Cross Correlation Function	1-13
1.6.2	Example of Cross Correlation	1-14
1.7	Ergodicity	1-14
1.7.1	Comparison of R.V. and R.P.	1-16
1.8	Transmission of a Random Process through a Linear Filter	1-17

1.9	PSD of a Random Process	1-18
1.9.1	Properties of PSD	1-19
1.10	Gaussian Process	1-21
1.10.1	Central Limit Theorem	1-22
1.10.2	Properties of a Gaussian Process	1-22
1.11	Noise	1-23
1.11.1	Some Sources of Noise	1-23
1.11.2	Thermal Noise or Johnson Noise	1-24
1.11.3	Shot Noise	1-24
1.12	White Gaussian Noise	1-25
1.12.1	Auto Correlation Function of White Gaussian Noise	1-25
1.13	Frequency Domain Representation of Noise	1-26
1.14	Spectral Components of Noise	1-28
1.15	Superposition of Noises	1-29
1.16	Effects of Linear Filtering on Noise	1-30
1.16.1	Effect of R-C Low Pass Filter	1-30
1.16.2	Effect of Rectangular (Ideal) Low Pass Filter	1-32
1.17	Narrow-Band Noise	1-33
1.18	Quadrature Components of Noise	1-34
1.18.1	Expressions for $n_c(t)$ and $n_s(t)$	1-34
1.18.2	Properties of Quadrature Components of Noise	1-35
1.18.3	Representation of Noise using Orthonormal Coordinates	1-36
1.18.4	Solved Examples	1-37
	• Review Questions	1-40

Unit II

Chapter 2 : Baseband Signal Receiver 2-1 to 2-27

Syllabus : Baseband signal receiver : Probability of error, Optimal receiver design.

2.1	Introduction	2-2
2.1.1	Digital Communication System	2-2
2.1.2	An optimum receiver	2-3
2.1.3	Types of receivers	2-3
2.2	Probability of Error (P_e)	2-3
2.3	Vector Space Representation of Signals	2-3
2.3.1	Unit Vectors	2-3
2.3.2	Representation of a Vector	2-3
2.3.3	Scalar Product of Vectors	2-3
2.3.4	Independent Vectors	2-4
2.3.5	Basis Vectors	2-4
2.4	Signal as a Vector	2-4
2.4.1	Concept of Signal Space	2-4



2.4.2	Vectors of Orthogonal Signals	2-5	3.5	Classification of Digital Modulation	3-5
2.5	Geometric Representation of Signals	2-5	3.6	Constellation Diagram	3-5
2.5.1	Signal Space Representation	2-6	3.7	Phase Shift Keying (PSK)	3-6
2.5.2	Maximum Likelihood Detection	2-6	3.8	Binary Phase Shift Keying (BPSK)	3-6
2.6	Baseband Signal Receiver	2-7	3.8.1	BPSK Generation	3-7
2.7	Integrate and Dump Receiver	2-8	3.8.2	BPSK Coherent Receiver	3-7
2.7.1	Signal to Noise Ratio of Integrate and Dump Receiver (Filter)	2-9	3.8.3	Spectrum of BPSK	3-8
2.7.2	Probability of Error for Integrate and Dump Receiver	2-11	3.8.4	Bandwidth of BPSK	3-9
2.8	The Optimum Receiver	2-15	3.8.5	Geometrical Representation of BPSK	3-10
2.8.1	Probability of Error for an Optimum Receiver	2-15	3.8.6	Euclidian Distance (D)	3-10
2.8.2	Optimum Filter Transfer Function H (f)	2-17	3.8.7	Error Probability of BPSK (with Coherent Detection)	3-11
2.9	Matched Filter	2-19	3.8.8	Constellation Diagram of BPSK	3-12
2.9.1	Impulse Response of a Matched Filter ...	2-19	3.8.9	Advantages of BPSK	3-12
2.9.2	Probability of Error the Matched Filter ...	2-20	3.8.10	Disadvantage of BPSK	3-12
2.9.3	Signal to Noise Ratio of a Matched Filter	2-21	3.8.11	Applications	3-12
2.9.4	Properties of Matched Filter	2-21	3.9	Binary Frequency Shift Keying (FSK)	3-13
2.10	Correlator	2-25	3.9.1	Generation of BFSK	3-14
2.10.1	Correlator Realization of a Matched Filter	2-25	3.9.2	Spectrum of BFSK	3-15
2.11	Maximum-Likelihood Receiver	2-26	3.9.3	Bandwidth of BFSK	3-15
2.12	Correlator Receiver	2-27	3.9.4	Coherent BFSK Receiver	3-16
	• Review Questions.....	2-27	3.9.5	Non-coherent BFSK Receiver	3-16
Unit II			3.9.6	Geometric Representation of Orthogonal BFSK	3-17
Chapter 3 : Digital Modulation-I			3.9.7	Geometric Representation of Non-orthogonal BFSK Signals	3-17
3-1 to 3-39			3.9.8	Bit Error Probability of BFSK	3-18
Syllabus : Digital modulation : Generation, Reception, Signal space representation and probability of error calculation for Binary Phase Shift Keying (BPSK), Binary Frequency Shift Keying (BFSK), Quadrature Phase Shift Keying (QPSK), M-ary Phase Shift Keying (MPSK).			3.9.9	Advantages of BFSK	3-20
3.1	Introduction	3-2	3.9.10	Disadvantages of BFSK	3-20
3.1.1	Digital Modulation Techniques	3-2	3.9.11	Applications of BFSK	3-20
3.1.2	Probability of Error (P_e)	3-2	3.10	Quadrature PSK (QPSK)	3-21
3.1.3	Power Spectra	3-2	3.10.1	Principle and Waveforms	3-21
3.1.4	Bandwidth Efficiency	3-2	3.10.2	Mathematical Representation of QPSK	3-22
3.2	Pass-band Transmission Model	3-3	3.10.3	Symbol Transmission Rate	3-22
3.3	Digital Modulation	3-3	3.10.4	Constellation Diagram of QPSK	3-23
3.3.1	Types of Digital Modulation	3-4	3.10.5	Offset QPSK (OQPSK) Transmitter	3-23
3.4	Binary and M-ary Transmission	3-5	3.10.6	Non-offset QPSK Transmitter	3-25
3.4.1	Binary transmission	3-5	3.10.7	The QPSK Receiver	3-26
3.4.2	M-ary Transmission	3-5	3.10.8	Signal Space Representation of QPSK ...	3-28
			3.10.9	Spectrum of QPSK	3-29
			3.10.10	Bandwidth of QPSK	3-30
			3.10.11	Error Probability for QPSK System	3-30
			3.10.12	Advantages of QPSK	3-31
			3.10.13	Disadvantage	3-32
			3.10.14	Applications	3-32
			3.10.15	QPSK is Better than PSK	3-32
			3.11	Comparison of BFSK, BPSK, QPSK	3-33



3.12	M-ary PSK	3-34
3.12.1	Euclidian Distance (d)	3-34
3.12.2	8-PSK System	3-35
3.12.3	PSD and Bandwidth of M-ary PSK	3-35
3.12.4	M-ary PSK Transmitter	3-36
3.12.5	M-ary PSK Receiver	3-37
3.12.6	Advantages of M-ary PSK	3-37
3.12.7	Disadvantages of M-ary PSK	3-38
3.12.8	Probability of Symbol Error for MPSK	3-39
	• Review Questions.....	3-39

Unit III

Chapter 4 : Digital Modulation-II 4-1 to 4-20

Syllabus : Generation, Reception, Signal space representation and probability of error calculation for Quadrature Amplitude Shift Keying (QASK), M-ary FSK (MFSK), Minimum Shift Keying (MSK), Comparison of digital modulation systems.

4.1	Introduction	4-2
4.2	Quadrature Amplitude Shift Keying (QASK) or QAM	4-2
4.2.1	Geometrical Representation of QASK	4-2
4.2.2	Types of QAM	4-3
4.2.3	4 QAM and 8 QAM Systems	4-3
4.2.4	QASK Transmitter	4-4
4.2.5	QASK Receiver	4-5
4.2.6	PSD and Bandwidth of QASK System	4-6
4.2.7	Error Probability of 16 QAM	4-6
4.2.8	Comparison of QASK and QPSK	4-6
4.2.9	Comparison of 16 PSK with 16 QASK	4-7
4.3	M-ary FSK System	4-8
4.3.1	Spectrum of M-ary FSK	4-8
4.3.2	Bandwidth of M-ary FSK	4-9
4.3.3	Advantage of M-ary FSK	4-9
4.3.4	Disadvantages	4-9
4.3.5	Geometric Representation of M-ary FSK	4-9
4.3.6	Probability of Symbol Error for MFSK (Coherent Detection)	4-9
4.3.7	Comparison of MPSK and MFSK	4-10
4.4	Minimum Shift Keying (MSK)	4-10
4.4.1	Waveforms of MSK	4-10
4.4.2	Expression for MSK Signal	4-11
4.4.3	MSK is called as Shaped QPSK	4-11
4.4.4	To Prove that MSK is FSK	4-12
4.4.5	Values of f_H and f_L	4-12
4.4.6	Signal Space Representation of MSK	4-13

4.4.7	Phase Continuity in MSK	4-14
4.4.8	MSK Transmitter	4-15
4.4.9	MSK Receiver	4-16
4.4.10	Advantages of MSK	4-16
4.4.11	Disadvantages of MSK System	4-17
4.4.12	PSD and Bandwidth of MSK	4-17
4.4.13	Comparison of QPSK and MSK Spectra	4-17
4.4.14	Gaussian MSK	4-18
4.4.15	Comparison of OQPSK and MSK	4-18
4.5	Comparison of Digital CW Systems	4-19
	• Review Questions	4-20

Unit III

Chapter 5 : Pulse Shaping 5-1 to 5-27

Syllabus : Pulse shaping to reduce Interchannel and Intersymbol interference, Some issues in transmission and reception, Orthogonal Frequency Division Multiplexing (OFDM).

5.1	Introduction	5-2
5.2	Baseband System	5-2
5.3	Line Coding	5-2
5.3.1	Classification of Line Codes	5-3
5.3.2	Properties of Line Codes	5-4
5.3.3	Unipolar RZ Line Code	5-5
5.3.4	Unipolar NRZ Format	5-5
5.3.5	Polar RZ Line Code	5-6
5.3.6	Polar NRZ Line Code	5-6
5.3.7	Bipolar NRZ Format (AMI)	5-7
5.3.8	Split Phase Manchester Format	5-7
5.3.9	Polar Quaternary NRZ Format	5-8
5.4	Power Spectra of Line Codes	5-8
5.4.1	Data signalling rate	5-9
5.4.2	Modulation Rate	5-9
5.4.3	Power Spectra	5-9
5.4.4	PSD of NRZ Unipolar Format	5-9
5.4.5	PSD of NRZ Polar Format	5-10
5.4.6	PSD of NRZ Bipolar Format	5-10
5.4.7	PSD of the Manchester Format	5-11
5.5	Comparison of Line Codes Base on Power Spectra	5-13
5.5.1	Comparison of Line Codes	5-13
5.6	Pulse Transmission through a Band limited Channel	5-15
5.7	Inter-symbol Interference (ISI)	5-15
5.7.1	Causes of Inter symbol Interference	5-17



5.7.2	Effect of ISI	5-17
5.7.3	Remedy to Reduce the ISI	5-17
5.8	Nyquist Criterion for Distortionless Baseband Binary Transmission	5-18
5.8.1	Ideal Solution	5-19
5.8.2	Raised Cosine Spectrum	5-20
5.9	Eye Pattern	5-21
5.10	Equalization	5-23
5.10.1	Tapped Delay Line Filter	5-23
5.10.2	Adaptive Equalizer	5-24
5.11	Inter-Channel interference (ICI)	5-24
5.11.1	Comparison of ISI and Inter-channel Interference	5-24
5.12	Orthogonal Frequency Division Multiplexing (OFDM)	5-25
5.12.1	Orthogonality	5-25
5.12.2	Assigning the Subcarriers	5-25
5.12.3	Generation of OFDM Signals	5-26
	• Review Questions	5-27

Unit IV

Chapter 6 : Spread Spectrum Modulation 6-1 to 6-38

Syllabus : Use of spread spectrum, Direct Sequence (DS) spread spectrum, Spread spectrum and Code Division Multiple Access (CDMA), Ranging using DS spread spectrum, Frequency Hopping (FH) spread spectrum, **Pseudorandom (PN) sequences** : Generation and characteristics, Synchronization in spread spectrum systems.

6.1	Introduction	6-2
6.2	Classification of the Spread Spectrum Modulation Techniques	6-3
6.2.1	Model of Spread Spectrum Modulation System	6-4
6.3	Pseudo-Noise (PN) Sequences	6-5
6.3.1	Definition of a PN Sequence	6-5
6.3.2	The Maximum Length Sequence	6-6
6.3.3	Properties of Maximum-Length Sequences	6-6
6.3.4	Auto-correlation Function of PN Sequences	6-7
6.3.5	Power Spectral Density of PN Sequence	6-7
6.4	Direct Sequence Spread Spectrum (DSSS)	6-12
6.4.1	DSSS Transmitter	6-12
6.4.2	DS-SS Receiver	6-13
6.4.3	Performance Parameters of a DS-SS System	6-13

6.4.4	Advantages of DS-SS System	6-15
6.4.5	Disadvantages of DS-SS System	6-15
6.4.6	Applications of DS-SS System	6-15
6.5	Code Division Multiple Access (CDMA)	6-18
6.5.1	Spread Spectrum and CDMA	6-19
6.6	Frequency Hop Spread Spectrum (FH-SS)	6-19
6.6.1	Operation of FHSS	6-20
6.6.2	Types of FHSS	6-21
6.7	Slow Frequency Hopping	6-21
6.7.1	FH/FMSK Transmitter	6-21
6.7.2	FH / MFSK Receiver	6-22
6.7.3	Chip Rate (R_c) of FH/MFSK System	6-23
6.7.4	Processing Gain PG	6-23
6.7.5	Bandwidth of Spread Signal	6-23
6.7.6	BW of Unspread Signal and Processing Gain	6-23
6.8	Fast Frequency Hopping	6-27
6.8.1	Receiver used for Fast Hopping	6-28
6.8.2	Advantages of FH-SS System	6-32
6.8.3	Disadvantages of FH-SS System	6-32
6.8.4	Applications of FHSS	6-32
6.8.5	Comparison of Slow and Fast Frequency Hopping	6-32
6.8.6	Comparison of DS-SS and FHSS	6-33
6.9	Synchronization of S.S. Technique	6-33
6.9.1	Acquisition (Coarse Synchronization) of a FH Signal	6-33
6.9.2	Tracking (Fine Synchronization) of a FH Signal	6-35
6.9.3	Acquisition (Coarse Synchronization) of a DS Signal	6-36
6.9.4	Tracking (Fine Synchronization) of a DS Signal	6-37
6.10	Applications of S.S. Technique.....	6-37
	• Review Questions	6-38

Unit V

Chapter 7 : Information Theory 7-1 to 7-59

Syllabus : Introduction to information theory, Entropy and its properties, Source coding theorem, Huffman coding, Shannon Fano coding, Discrete memoryless channel, Mutual information, Channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensemble, Information capacity theorem.

7.1	Introduction to Information Theory	7-2
7.1.1	Uncertainty and Information	7-2
7.2	Information (Measure of Information)	7-3



7.2.1	Properties of Information	7-3
7.3	Types of Sources and their Models	7-4
7.3.1	Analog Information Sources	7-5
7.3.2	Discrete Information Sources	7-5
7.4	Average Information or Entropy	7-5
7.4.1	Expression for Entropy	7-5
7.4.2	Properties of Entropy	7-6
7.4.3	Entropy of a Binary Memoryless Source ..	7-7
7.5	Information Rate (R)	7-8
7.6	Shannon's First Theorem (Source Coding Theorem)	7-10
7.6.1	Shannon-Fano Code	7-11
7.6.2	Shannon - Fano Algorithm	7-11
7.6.3	Huffman Coding	7-16
7.6.4	Comparison of Shannon Fano and Huffman Coding	7-26
7.6.5	Applications of Source Coding	7-27
7.7	Types of Channels	7-27
7.7.1	Binary Symmetric Channel	7-27
7.7.2	Discrete Memoryless Channels (DMC) ..	7-28
7.7.3	Joint, Conditional and Marginal Probabilities	7-29
7.8	Types of Entropy	7-30
7.8.1	Joint Entropy	7-30
7.8.2	Conditional Entropy	7-30
7.8.3	Relationship between the Conditional and Joint Entropies	7-30
7.9	Mutual Information	7-31
7.9.1	Average Mutual Information	7-31
7.9.2	Expressions for Mutual Information	7-31
7.9.3	Properties of Mutual Information	7-32
7.10	Channel Capacity	7-44
7.10.1	Channel Capacity of a BSC	7-44
7.11	Channel Coding Theorem	7-48
7.12	Differential Entropy and Mutual Information for Continuous Ensembles	7-50
7.12.1	Differential Entropy of a Uniform Distribution	7-50
7.12.2	Mutual Information	7-51
7.13	Information Capacity Theorem	7-51
7.13.1	Trade-off between B.W. and SNR	7-52
7.14	Implications of Information Capacity Theorem	7-57
	• Review Questions.....	7-59

Unit VI**Chapter 8 : Linear Block Codes****8-1 to 8-34**

Syllabus : Linear block codes : Coding, Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding.

8.1	Introduction	8-2
8.1.1	Error Control Techniques	8-2
8.1.2	Encoding and Decoding	8-2
8.2	Definitions Related to Codes	8-3
8.2.1	Code Word	8-3
8.2.2	Code Rate	8-3
8.2.3	Hamming Weight $w(x)$	8-3
8.2.4	Code Efficiency	8-3
8.2.5	Hamming Distance	8-3
8.2.6	Minimum Distance d_{min}	8-4
8.3	Error Detection Techniques	8-4
8.3.1	Parity Checking	8-4
8.3.2	Two Dimensional Parity Check (Block Parity)	8-5
8.3.3	Checksum Error Detection	8-7
8.4	Error Correction Techniques	8-8
8.5	Error-correcting Codes	8-8
8.5.1	Linear Codes	8-8
8.5.2	Non-Linear Codes	8-9
8.5.3	Classification Based on the Functioning ..	8-9
8.6	Linear Block Codes	8-9
8.6.1	Generation of block code (LBC)	8-10
8.6.2	Code Word Structure of LBC.....	8-10
8.6.3	Matrix Representation of LBC	8-10
8.6.4	Generator Matrix of LBC	8-10
8.6.5	Generation of Code Words Using Generator Matrix	8-11
8.6.6	Systematic Form of Generator Matrix	8-12
8.6.7	Systematic Code Word	8-12
8.7	Decoding of a Linear Block Code	8-13
8.7.1	Error Detection Capability	8-13
8.7.2	Error Correcting Capability	8-13
8.8	Encoder Implementation	8-15
8.9	Parity Check Matrix of Block Codes	8-16
8.9.1	Error Detection using Parity Check Matrix	8-16
8.9.2	Relation between H and d_{min}	8-17
8.10	Decoding LBC using Parity Check Matrix	8-19
8.10.1	Shannon's Limit	8-21
8.11	Standard Array and Syndrome Decoding	8-21
8.11.1	Error Vector (E)	8-21
8.11.2	Syndrome Vector (S)	8-21



8.11.3	Standard Array	8-22
8.11.4	Procedure for Syndrome Decoding	8-22
8.12	Syndrome Generator	8-32
8.13	Hamming Codes	8-32
8.13.1	Error Detection and Correction Capabilities of Hamming Code	8-33
	• Review Questions.....	8-34

Unit VI

Chapter 9 : Cyclic Codes 9-1 to 9-25

Syllabus : Cyclic codes : Coding and decoding.

9.1	Introduction to Cyclic Codes	9-2
9.1.1	Definition of Cyclic Code	9-2
9.2	Polynomial Representation of Cyclic Codes	9-3
9.3	Generating the Cyclic Codes	9-3
9.3.1	Generator Polynomial	9-3
9.3.2	Generation of Non-systematic Code Words	9-4
9.4	Systematic Cyclic Codes	9-5
9.4.1	Generation of Systematic Code words	9-5
9.5	Matrix Description of Cyclic Codes	9-6
9.5.1	Generator Matrices of the Cyclic Codes	9-6
9.5.2	Systematic Form of Generator Matrix	9-6
9.6	Parity Check Matrix	9-7
9.7	Syndrome Decoding of Cyclic Codes	9-9
9.7.1	Syndrome Polynomial	9-9
9.7.2	Syndrome Decoding	9-9
9.7.3	Advantages of Cyclic Codes	9-12
9.7.4	Disadvantages of Cyclic Codes	9-12
9.8	Circuit Implementation of Cyclic Codes.....	9-12
9.8.1	The Circuit Elements used in Encoder or Decoder	9-13
9.8.2	Encoder for the Cyclic Codes	9-13
9.8.3	Drawing the Encoder Circuit	9-14
9.9	Non-algebraic Decoding of Cyclic Codes	9-19
9.9.1	Syndrome Calculator for the Systematic Cyclic Codes	9-19
	• Review Questions.....	9-25

Unit VI

Chapter 10 : Convolutional Codes 10-1 to 10-37

Syllabus : Convolutional codes : Coding and decoding, Introduction to turbo codes and LDPC codes.

10.1	Introduction to Convolution Codes	10-2
------	---	------

10.1.1	Tree Codes and Convolution Codes	10-2
10.1.2	Convolution Encoder	10-2
10.1.3	Word length (k)	10-3
10.1.4	Block length (n)	10-3
10.1.5	Simplified Convolution Encoder	10-3
10.2	Graphical Representation for Convolution Encoding	10-5
10.2.1	State Diagram	10-5
10.2.2	Trellis Diagram.....	10-5
10.2.3	Encoding using the Trellis Diagram	10-6
10.3	Mathematical Representation of Encoding	10-6
10.3.1	Practical Convolution Encoder	10-7
10.3.2	Definitions For Convolution Codes	10-7
10.3.3	Time Domain Approach (Impulse Response of Encoder)	10-8
10.3.4	Transform - Domain Approach (Polynomial Description of Convolution Codes)	10-10
10.3.5	Graphical Representation	10-11
10.3.6	The Code Tree	10-11
10.3.7	Code Trellis	10-13
10.3.8	State Diagram	10-13
10.3.9	Parity Check Matrix	10-14
10.3.10	Syndrome Polynomial Vector	10-14
10.3.11	Systematic Encoder	10-14
10.4	Decoding Methods of Convolution Codes	10-24
10.4.1	Viterbi Decoding	10-24
10.4.2	Hard-Decision Viterbi Decoding	10-24
10.4.3	Metric Diversion Effect	10-27
10.4.4	Decoding Window	10-27
10.4.5	Soft Decision Viterbi Decoding	10-27
10.4.6	Sequential Decoding	10-29
10.4.7	Comparison of Convolution Codes and Block Codes	10-33
10.5	Turbo Codes	10-33
10.5.1	Encoder for Turbo Codes	10-34
10.5.2	Decoder for Turbo Codes	10-35
10.6	LDPC Codes.....	10-36
10.7	University Questions and Answers	10-36
	• Review Questions	10-36
	• Appendix A	A-1 to A-2
	• Appendix B	B-1
	• Appendix C	C-1
	• Appendix D	D-1 to D-2
	• Appendix E	E-1
	• Appendix F	F-3

