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ELECTRONICS ENGINEERING GROUP

'G' Scheme
Semester V
MSBTE

DIGITAL COMMUNICATION

Mrs. P. D. KULKARNI

NIRALI PRAKASHAN

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For

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As Per MSBTE's 'G' Scheme Syllabus

Mrs. Pratibha D. Kulkarni
M.Tech., (E & TC)
Sr. Lecturer, E & TC Department
Pimpri-Chinchwad Education Trust's
Pimpri-Chinchwad Polytechnic.
Nigdi, PUNE - 44.

Miss Sharvari D. Kulkarni
B.E. (E & TC)

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Dedicated to my beloved Father

Shri. Krishnaji A. Deshpande (Principal)

Mother

Late Sau. Sunita K. Deshpande

– Mrs. Pratibha D. Kulkarni

Preface ...

It gives us great pleasure and feeling of satisfaction in presenting this text book of **'Digital Communication'** for students of **Fifth** Semester Diploma Courses in Electronics, Electronics and Telecommunication, Digital Electronics Branches. Also this book is useful for students of **Sixth Semester ED/EI** branches. Note that MSBTE Questions are given only on old topics included in new syllabus. This text has been written as per MSBTE's 'G' Scheme.

On some topics MSBTE questions are not given because that are newly added in this syllabus.

This subject is presented in simple language into consideration of requirements of all the students regarding the latest and changing treads of examination. Every care has been taken to check the mistakes and misprints, yet it is very difficult to claim perfection.

I take this opportunity to thank **Hon. Secretary Shri. V. S. Kalbhor, Hon. A. O. Shri. Vispute, Hon. Principal Mrs. V. S. Byakod and Hon. Vice-Principal Shri. B. V. Mane** for their moral support and encouragement.

I also thanks to **Shri. M. P. Munde** whose inspiration and constant promoting are responsible for producing this book in short period. I also thankful to publisher **Shri. Dineshbhai Furia** and **Shri. Jignesh Furia.** I am also thankful to Mr. Malik Shaikh, Mrs. Anagha Medhekar (Co-ordination and Proof Reading), Mrs. Anjali Muley (Figure Drawing) and staff of Nirali Prakashan for bringing out this book.

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Any undetected and unintentional error, omissions, suggestions etc. from students and teachers for improvement brought to our notice in good spirit are most welcome.

Pune **Author**

Syllabus ...

Chapter 1 : Introduction of Digital Communication [Hrs. : 02, Mks. : 06]

- Historical Perspective of Digital Communication
- Elements of Digital Communication System with its Block Diagram.
- Communication Channel Types and their Characteristics (Bit Rate, Bandwidth, Repeater Distance) Applications, and Channel Modelling, Channel Noise.
- Comparison of Analog and Digital Communication System.

Chapter 2: Digital Pulse Modulation Techniques [Hrs. : 12, Mks. : 20]

2.1 **[04 Marks]**

- Sampling Process Nyquist Sampling Theorem.
- Quantization Process, Quantization Error, Quantization Noise, Uniform, Non-uniform Quantization (Companding) μ-law, A-Law (Concept)

2.2 **[16 Marks]**

- Pulse Code Modulation (PCM) Transmitter and Receiver Block Diagram and its Working. Advantage and Disadvantages of PCM.
- Differential Pulse Code Modulation (DPCM). Transmitter and Receiver Block Diagram and its Working, Advantage and Disadvantage of DPCM
- Delta Modulation (DM) Block Diagram of Transmitter and Receiver, Slope Overload and Granular Noise, Advantage and Disadvantage of DM.
- Adaptive Delta Modulation (ADM) Transmitter and Receiver Block Diagram. Advantage and Disadvantages of ADM
- Comparison of Analog and Digital Pulse Modulation, Comparison of Various Digital Pulse Modulation

Chapter 3: Coding Methods and Error Control [Hrs. : 08, Mks. : 16]

3.1 **[06 Marks]**

- Bits, Bit Rate and Baud Rate, Hartleys Law, Shannon Hartleys Theorem, Channel Capacity
- Source Coding, sources, Entropy, Baudot Code, Huffman Coding.

3.2 **[10 Marks]**

- Channel Coding: Error, Causes of Error and its Effect, Error Detection and Correction using Parity, Error Control Codes, Checksum, Two Dimensional Parity Check Vertical Redundancy Check (VRC), Longitudinal Redundancy Check (LRC), Cyclic Redundancy Check (CRC), Hamming Codes.
- Line Coding: Classification of Line Codes uni polar, Polar Non-return to Zero (NRZ) and Return to Zero (RZ), Bipolar (NRZ), Manchester (Split Phase), Differential Manchester Bipolar RZ, Pseudo Ternary, Alternate Mark Inversion (AMI) and their Waveforms.

Chapter 4: Digital Modulation Technique **[Hrs. : 12, Mks. : 24]**

- M-ary Encoding, Minimum Bandwidth
- Amplitude Shift Keying (ASK) Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Transmitter and Receiver Block Diagram and their Working with Waveform.
- Quadrature Phase Shift Keying (QPSK), Quadrature Amplitude Modulation (QAM), Differential Phase Shift Keying (DPSK) Transmitter and Receiver Block Diagram and their Working with Waveform.
- Constellation Diagram and Phasor Diagram of each Modulation Techniques.
- Comparison of Digital Modulation Technique along with Bandwidth of each one.

Chapter 5: Multiplexing and Multiple Access **[Hrs. : 08, Mks. : 20]**

5.1 **[10 Marks]**

- Need of Multiplexing Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM), Code Division multiplexing (CDM), Space Division Multiplexing (SDM) Definition, Block Diagram and their Comparison.
- T-carrier System, Digital Multiplexing Hierarchy, North American Hierarchy, The CCITT Digital Multiplexing Hierarchy
- Introduction to Wavelength Division Multiplexing (WDM)

5.2 **[10 Marks]**

- Access Techniques Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA), Space Division Multiple Access (SDMA), Comparison of Different Access Techniques.
- Wide Band Modulation Techniques: Orthogonal Frequency Division Multiplexing (OFDM) Basic Principle of Orthogonality, Single vs. Multicarrier System OFDM Block Diagram and its Explanation. Comparisons between CDMA and OFDM

Chapter 6: Spread Spectrum Modulation **[Hrs. : 06, Mks. : 14]**

6.1 **[06 Marks]**

- Introduction to Spread Spectrum (SS) Modulation, Advantages over Fixed Frequency, Types of SS Modulation Applications of SS Modulation.
- Pseudo Noise (PN) Sequence: Definition, Generation and Maximum Length Sequence
- Model of Spread Spectrum Modulation System

6.2 **[08 Marks]**

- Direct Sequence Spread Spectrum Signal.
- Frequency Spread Spectrum. Slow Frequency Hopping and Fast Frequency Hopping.
- Comparisons of Direct Sequence Spread Spectrum (DSSS) and Frequency Hop Spread Spectrum (FHSS)
- DSSS Based CDMA System, CDMA with FHSS Block Diagram

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CONTENTS

1. Introduction to Digital Communication **1.1 - 1.16**

1.1 Introduction 1.1
1.2 Historical Perspective of Digital Communication 1.2
1.3 Elements of Digital Communication System (Basic Block Diagram) 1.4
1.4 Communication Channel, Types and their Characteristics 1.5
1.4.1 Characteristics of Channel 1.6
1.4.2 Channel Noise and its Effect 1.7
1.4.3 Channel Modelling 1.10
1.5 Why Digital Communication ? 1.12
1.6 Advantages and Disadvantages of Digital Communication System 1.13
1.7 Comparison of Analog and Digital Communication System 1.14
1.8 Characteristics of Communication Channels 1.14
• Important Points 1.15
• Practice Questions 1.16
• MSBTE Questions and Answers (As Per 'G' Scheme) 1.16

2. Digital Pulse Modulation Techniques **2.1 - 2.36**

2.1 Introduction 2.1
2.1.1 Digital Modulation Classification 2.2
2.2 Signal Processing 2.3
2.3 Sampling process 2.4
2.3.1 Sampling Theorem 2.6
2.3.2 Nyquist Rate 2.6
2.3.3 Aliasing 2.7
2.3.4 Sampling Techniques 2.9
2.3.5 Natural Sampling 2.9
2.3.6 Flat-Top Sampling 2.11
2.3.7 Effect of Finite Pulse Width of the Sampling Signal 2.12
2.3.7 Comparison of Natural and Flat-Top Sampling 2.12
2.4 Quantization process 2.13
2.4.1 Quantization Error (Noise) 2.14
2.4.2 Uniform Quantization 2.15
2.4.3 Non-Uniform Quantization 2.16
2.4.4 Companding 2.17
2.4.5 μ-law Companding 2.18
2.4.6 A-law Companding 2.19
2.5 Pulse Code Modulation (PCM) 2.20
2.5.1 PCM Transmitter 2.21
2.5.2 PCM Receiver 2.22
2.5.3 Effect of Noise on PCM System 2.22
2.5.4 Advantages of PCM 2.23
2.5.5 Disadvantages of PCM 2.23
2.5.6 Applications of PCM 2.23

2.6 Differential Pulse Code Modulation (DPCM) 2.24
2.6.1 DPCM Transmitter 2.24
2.6.2 DPCM Receiver 2.25
2.6.3 Advantages of DPCM 2.25
2.6.4 Disadvantages of DPCM 2.25
2.6.5 Application of DPCM 2.25
2.7 Delta Modulation (DM) 2.26
2.7.1 DM Transmitter 2.26
2.7.2 DM Receiver 2.27
2.7.3 Distortions in DM System 2.27
2.7.4 Advantages of Delta Modulation 2.28
2.7.5 Disadvantage of Delta Modulation 2.28
2.7.6 Applications of DM 2.28
2.8 Adaptive Delta Modulation (ADM) 2.29
2.8.1 ADM Transmitter 2.29
2.8.2 Advantages of ADM 2.30
2.8.3 Disadvantage of ADM 2.30
2.8.4 Applications of ADM 2.30
2.9 Comparison of Analog and Digital Pulse Modulation 2.31
2.10 Comparison of PCM, Delta Modulation and Adaptive Delta Modulation 2.31
• Important Points 2.33
• Practice Questions 2.35
• MSBTE Questions and Answers (As Per 'G' Scheme) 2.35

3. Coding Methods and Error Control 3.1 - 3.68

3.1 Introduction 3.1
3.2 Digital Signal 3.2
3.2.1 Baud Rate and Bit Rate 3.2
3.2.2 Channel Bandwidth 3.5
3.2.3 Hartley's Law 3.6
3.2.4 Shannon-Hartley Theorem 3.6
3.2.5 Channel Capacity 3.8
3.3 Source Coding 3.9
3.3.1 Entropy 3.9
3.3.2 Baudot Code 3.10
3.3.3 Huffman Code 3.11
3.4 Channel Coding 3.14
3.5 Terms related to Codes 3.15
3.5.1 Code Word 3.15
3.5.2 Block Length 3.15
3.5.3 Code Rate (Code Efficiency) 3.15
3.5.4 Channel Data Rate 3.15
3.5.5 Parity 3.15
3.5.6 Parity Check Codes 3.16

3.6 Types of Errors 3.16
3.6.1 Single Bit Error 3.17
3.6.2 Burst Error 3.17
3.6.3 Causes and Effects of Errors 3.18
3.7 Error Detection 3.18
3.7.1 Parity Checking 3.19
3.7.2 Redundancy 3.20
3.7.3 Vertical Redundancy Check (VRC) 3.21
3.7.4 Longitudinal Redundancy Check (LRC) 3.23
3.7.5 Cyclic Redundancy Check (CRC) 3.23
3.7.6 The CRC Generator 3.25
3.7.7 The CRC Checker 3.26
3.7.8 Polynomials 3.26
3.7.9 Checksum 3.27
3.7.10 Checksum Generator 3.27
3.7.11 Checksum Checker 3.27
3.8 Error Correction 3.30
3.8.1 Single Bit Error Correction 3.30
3.8.2 Hamming Code 3.31
3.8.3 Calculating the P Values 3.34
3.8.4 Error Detection and Correction 3.34
3.8.5 Burst Error Correction 3.35
3.9 Line Coding 3.44
3.9.1 Unipolar 3.48
3.9.2 Polar 3.49
3.9.3 Bipolar 3.52
3.9.4 Biphase 3.54
3.10 Comparison between Encoding Techniques 3.55
• Important Points 3.62
• Practice Questions 3.65
• MSBTE Questions and Answers (As Per 'G' Scheme) 3.66

4. Digital Modulation Technique 4.1 - 4.44
4.1 Introduction: Modulation of Digital Data 4.1
4.2 Amplitude Shift Keying (ASK) 4.3
4.2.1 Ask Transmitter 4.3
4.2.2 Ask Receiver (Co-herent) 4.4
4.2.3 Advantages/Disadvantages and Applications of ASK 4.5
4.2.4 Comparison between AM and ASK 4.6
4.3 Frequency Shift Keying (FSK) 4.6
4.3.1 FSK Transmitter 4.6
4.3.2 FSK Receiver 4.7
4.3.3 Bandwidth of FSK 4.8
4.3.4 Advantages and Disadvantages/Applications of FSK 4.9

4.4 Binary Frequency Shift Keying (BFSK) 4.9
4.4.1 BFSK Transmitter 4.10
4.4.2 BFSK Receiver 4.11
4.4.3 Bandwidth of BFSK 4.12
4.5 Phase Shift Keying (PSK) 4.13
4.5.1 BPSK Transmitter 4.14
4.5.2 Constellation and Phasor Diagram for BPSK 4.14
4.5.3 BPSK Receiver 4.15
4.5.4 Bandwidth of BPSK 4.16
4.5.5 Advantages/Disadvantages and Applications of BPSK 4.17
4.6 Comparison between ASK, FSK and PSK 4.17
4.7 M-ary Encoding 4.18
4.7.1 Need of M-ary Encoding 4.18
4.7.2 Minimum Bandwidth (For M-ary Technique 4.19
4.7.3 Types of M-ary Systems 4.20
4.8 M-ary PSK 4.20
4.8.1 M-ary PSK Transmitter 4.20
4.8.2 M-ary PSK Receiver 4.21
4.8.3 Bandwidth of M-ary PSK 4.22
4.8.4 Advantages/Disadvantages of M-ary PSK 4.23
4.9 M-Ary FSK 4.23
4.9.1 M-ary FSK Transmitter 4.23
4.9.2 M-Ary FSK Receiver 4.24
4.9.3 Bandwidth of M-ary FSK 4.24
4.9.4 Advantages/Disadvantages of M-ary FSK 4.25
4.10 Comparison between M-Ary PSK and M-Ary FSK 4.25
4.11 QPSK 4.25
4.11.1 Offset QPSK (OQPSK) Transmitter 4.26
4.11.2 QPSK Phasor and Constellation Diagram 4.28
4.11.3 Non-Offset QPSK 4.29
4.11.4 QPSK Receiver 4.29
4.11.5 Bandwidth of QPSK 4.31
4.11.6 Advantages and Disadvantages and Applications of QPSK 4.32
4.11.7 Why QPSK is better than PSK? 4.32
4.11.8 Comparison between BPSK and QPSK 4.33
4.12 Quadrature Amplitude Modulation (QAM) or QASK 4.33
4.12.1 QAM Transmitter 4.34
4.12.2 Constellation Diagram of QAM 4.34
4.12.3 QAM or QASK Receiver 4.36
4.12.4 Bandwidth of QAM (i.e. QASK) Signal) 4.37
4.12.5 Advantages and Applications of QAM 4.37

4.13 Comparison of QASK and QPSK 4.37
4.14 Differential Phase-Shift Keying (DPSK) 4.37
4.14.1 DPSK Transmitter 4.38
4.14.2 DPSK Receiver 4.39
4.14.3 Bandwidth of DPSK Signal 4.39
4.14.4 Advantages and Disadvantages of DPSK 4.39
4.15 Comparison between BPSK and DPSK 4.40
4.16 Comparison of Digital Modulation Technique alongwith Bandwidth of Each 4.40
• Important Points 4.40
• Practice Questions 4.41
• MSBTE Questions and Answers (As Per 'G' Scheme) 4.42

5. Multiplexing and Multiple Access 5.1 - 5.36
5.1 Introduction 5.1
5.2 Multiplexing Techniques 5.2
5.3 Frequency-Division Multiplexing (FDM) 5.3
5.3.1 FDM Transmitter (Multiplexing Process) 5.4
5.3.2 FDM Receiver 5.5
5.3.3 Advantages and Disadvantages and Applications of FDM 5.6
5.4 Time-Division Multiplexing (TDM) 5.7
5.4.1 Synchronous TDM 5.9
5.4.2 Asynchronous TDM 5.11
5.4.3 Synchronizing 5.12
5.4.4 Advantages, Disadvantages and Applications of TDM 5.13
5.5 Wave-Division Multiplexing (WDM) 5.13
5.6 Code Division Multiplexing (CDM) 5.14
5.6.1 Comparison of FDM and TDM 5.15
5.7 Multiple Access Techniques
5.7.1 Frequency Division Multiple Access (FDMA) 5.16
5.7.2 Time Division Multiple Access (TDMA) 5.17
5.7.3 Code Division Multiple Access (CDMA) 5.19
5.7.4 Space Division Multiple Access (SDMA) 5.21
5.8 Comparison between FDMA, TDMA and CDMA 5.23
5.9 Wideband Modulation Techniques 5.23
5.9.1 Basic Principle of Orthogonality 5.23
5.9.2 OFDM Block Diagram 5.25
5.9.3 Single Vs. Multicarrier Systems 5.26
5.10 CDMA Vs OFDM 5.27
5.11 T-CARRIER 5.28
5.11.1 Digital Multiplexing Hierarchy 5.29
5.11.2 North American Digital Hierarchy 5.29
• Important Points 5.32
• Practice Questions 5.33
• MSBTE Questions and Answers (As Per 'G' Scheme) 5.33

6. Spread Spectrum Modulation **6.1 - 6.28**

6.1 Introduction 6.1

6.2 Concept of SS Bandwidth 6.2

6.3 Spread Spectrum Modulation Technique 6.3

6.3.1 Definitions and How to apply SS ? 6.4

6.3.2 How is the SS Signal different from Normal Signal ? 6.8

6.3.3 Advantages of Spread Spectrum (SS) 6.8

6.3.4 Applications of Spread Spectrum (S.S.) Modulation) 6.9

6.4 Pseudo-Noise Sequence (PN Sequence) 6.9

6.4.1 Maximum Length Sequences 6.10

6.5 Model of Spread Spectrum Communication System 6.12

6.6 Direct Sequence Spread Spectrum 6.13

6.6.1 DS Transmitter 6.14

6.6.2 DS Receiver 6.15

6.6.3 Advantages, Disadvantages and Applications of DSS 6.16

6.7 Frequency Hop Spread Spectrum (FHSS) 6.17

6.7.1 FHSS Transmitter and Receiver 6.18

6.7.2 Slow Frequency Hopping 6.20

6.7.3 Fast Frequency Hopping 6.22

6.7.4 Advantages and Disadvantages and Applications of Frequency Hopping Spread Spectrum 6.24

6.7.5 Comparison between Slow and Fast Frequency Hopping 6.24

6.8 Comparison of DS-SS and FH-SS 6.24

- Important Points 6.25
- Practice Questions 6.26
- MSBTE Questions and Answers (As Per 'G' Scheme) 6.27

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