DISCIPLINE SPECIFIC ELECTIVES (DSE-3)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Digital Communication System ELDSE7C	**4**	**3**	**-**	**1**	**Class XII passed with Physics + Mathematics/Applied Mathematics + Chemistry OR Physics + Mathematics/Applied Mathematics + Computer Science/Informatics Practices**	**-**

Learning Objectives

The course introduces students to the fundamentals and key modules of digital communication systems with emphasis on digital modulation techniques and error and code detection. The basics of information theory, source coding techniques and entropy of source will also be covered.

Learning outcomes

On successful completion of this course, students will be able to:

- Understand the concept of digital communication system.
- Compare various digital modulation and demodulation techniques.
- Understand the effect of noise on system performances.
- Generate coding sequences for different error correcting codes.

SYLLABUS OF ELDSE-7C **Total Hours- Theory: 45 Hours, Practicals: 30 Hours**

UNIT – I (12 Hours)

An overview of sampling theorem and multiplexing.

Random processes, stationary processes, mean, correlation, and covariance functions: autocorrelation function, cross-correlation function, Power spectral density.

Information Theory: Entropy, Information rate and channel capacity: Hartley's law, Shannon Hartley's theorem, Source coding: Huffman coding.

UNIT – II (12 Hours)

Digital base band transmission and Reception: line coding (Unipolar Return to Zero (RZ), Unipolar Non-Return to Zero (NRZ), Bipolar NRZ, split phase Manchester, differential coding) comparison in performance and Power spectra density. Probability of error, ISI, Matched filter, probability of error using matched filter.

UNIT – III (10 Hours)

Digital Modulation Schemes: ASK(Amplitude Shift Keying), FSK(Frequency Shift Keying), PSK(Phase Shift Keying), DPSK(Differential Phase Shift Keying), QPSK(Quadrature Phase Shift Keying), QAM(Quadrature Amplitude Modulation) and M-ary coding. Constellation diagram, transmitter and receiver block diagram.

UNIT – IV (11 Hours)

Channel/line coding: ASCII and EBCDIC binary codes, Error, Error detection and correction using parity, checksum, Vertical redundancy Check (VRC), Longitudinal Redundancy Check (LRC), Cyclic Redundancy Check (CRC), Linear block code, Hamming code.

Practical component (if any) – Digital Communication System Lab
(Hardware and/or software using MATLAB/SCILAB)

Learning outcomes

The Learning Outcomes of this course are as follows:

- Understand sampling.
- Understand basic theories and generation and detection of Digital communication techniques.
- Simulate and use software for applications in communication electronics.

LIST OF PRACTICALS (Total Practical Hours- 30 Hours)

1. Study Sampling theorem using software.
2. Study of generation of Unipolar and bipolar RZ & NRZ Line coding.
3. Study of Amplitude Shift Keying (ASK).
4. Study of Frequency Shift Keying (FSK).

5. Simulate Phase Shift Keying (PSK)- Binary Phase Shift Keying (BPSK)- and Quadrature Phase Shift Keying (QPSK) using software.
6. Study of Quadrature amplitude Modulation (QAM).
7. Study the Hamming Code-7bit generation.

Note: Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than six.

Essential/recommended readings

1. W. Tomasi, Electronic Communication Systems: Fundamentals through Advanced, Pearson Education (2024), 5th Edition
2. S. Haykin, Digital Communication, John Wiley India (Circa 2021), 3rd Edition
3. B. Sklar, Digital Communication, 2nd Edition, Pearson Education (2024)
4. J.G. Proakis, Fundamentals of Communication Systems, Pearson Education (2024), 2nd Edition

Suggestive readings

1. L. W. Couch II, Digital and Analog Communication Systems, Pearson Education (2005)
2. H. P. Hsu, Analog and Digital Communications, Tata McGraw Hill (2006)

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.