NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
B.Tech. Electronics & Communication Engineering
Semester - V

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Course Code	**2EC503**
Course Title	**Digital Communication**

Course Outcomes (COs):
At the end of the course, the students will be able to

1. Analyze the process of converting the baseband signal into a passband signal using various digital modulation techniques.
2. Apply the spread spectrum modulation principles in communication systems.
3. Appreciate the role of information theory and error control coding for obtaining error-free communication.
4. Comprehend the fundamental concepts of wireless communication.

Syllabus: **Teaching Hours:45**

UNIT I: Signal Space Analysis **04**

Signal space representation of energy signals, Grand-Smith orthogonalisation procedure, Conversion of the continuous Additive White Gaussian Noise (AWGN) channel into a vector channel, detection of known signals in AWGN, Maximum Likelihood detection and Correlation receiver, Matched filter.

UNIT II: Passband Digital Transmission **12**

Passband transmission model, Coherent phase shift keying, Hybrid amplitude/phase modulation schemes, QAM, Coherent frequency shift keying, Detection of signals with unknown phase, Noncoherent Binary Frequency shift keying, Differential phase-shift Keying, Comparison of Digital Modulation Schemes, Multichannel modulation and OFDM, Synchronization, Carrier recovery and symbol timing.

UNIT III: Spread-Spectrum Modulation

Pseudo-Noise Sequences, A Notion of spread Spectrum, Direct-Sequence Spread Spectrum with Coherent Binary Phase-shift Keying, Signal-Space Dimensionality and processing Gain, Probability of Error, Frequency Hop Spread Spectrum, Scrambler. **06**

UNIT IV: Information Theory

Uncertainty, Information and Entropy, Source Coding Theorem, Channel Capacity, Channel Coding Theorem, Channel Capacity of various channel, Shannon's theorem of error-free communication **08**

UNIT V: Error-Control Coding

Linear Block Codes, Cyclic Codes, Convolutional Codes, Maximum Likelihood Decoding of Convolutional Codes, Viterbi algorithm **08**

UNIT VI: Fundamentals of Wireless Communication

Wireless channel characterization, Multipath propagation, Types of the fading channel, Cellular concepts- frequency reuse, handoff, channel assignment, Multiple-Access Techniques – FDMA, TDMA & CDMA **07**

Self-Study:
The self-study content will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Laboratory Work:
Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Suggested Readings:

1. S. Haykin, Communication Systems, John Wiley & Sons
2. B. P. Lathi, Modern Digital and Analog Communications Systems, Oxford University Press
3. T. Rappaport, Wireless Communication- Principles and Practices, Pearson Education
4. B. Sklar, Digital Communication Fundamentals and Applications, Pearson Education
5. J. Proakis, Digital Communications, Tata McGraw Hill

L = Lecture, T = Tutorial, P = Practical, C = Credit