**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
**Syllabus for B. Tech in Electronics & Communication Engineering**
(Applicable from the academic session 2018-2019)

| EC503 | Digital Communication and Stochastic | 3L:1T:0P | 3.5 credits |
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**Mod-1** **8L**

*Introduction to Stochastic Processes (SPs):*
Definition and examples of SPs, classification of random processes according to state space and parameter space,elementary problems. Stationary and ergodic processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density.
Definition and examples of Markov Chains, transition probability matrix, ChapmanKolmogorov equations; calculation of n-step transition probabilities.

**Mod-2** **6L**

*Signal Vector Representation:*
Analogy between signal and vector, distinguishibility of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point , signal constellation, geometric interpretation of signals, likelihood functions, Schwartz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error , error function, complementary error function, Type-I and Type-II errors.

**Mod-3** **10L**

**Digital Data Transmission:**
Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and µ -law companding, differential PCM, delta modulation and adaptive delta modulation.
Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding – polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction

**Mod-4** **10L**

*Digital Modulation Techniques:*
Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, basic digital carrier modulation techniques: ASK, FSK and PSK,

Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK.
Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-aryPSK, power spectra of MPSK,
Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSKsignals, power spectra of QPSK signals, Offset Quadrature Phase shift Queuing (OQPSK),
Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying: GMSK, basic concept of OFDM, constellation diagram,

Some performance issues for different digital modulation techniques - Error Vector Magnitude (EVM), Eye Pattern and Relative Constellation Error (RCE), Conceptual idea for Vector Signal Analyzer (VSA)

**Text Books:**
1) Digital Communications, S. Haykin, Wiley India.
2) Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.
3) Wireless Communication and Networks : 3G and Beyond, I. SahaMisra, TMH Education.
4) Digital Communications, J.G.Proakis, TMH Publishing Co.
5) S.M. Ross,Stochastic Processes, 2nd Edition, Wiley, 1996 (WSE Edition).

**References:**
1) Digital Communications Fundamentals andApplications, B. Sklar and P.K.Ray, Pearson.
2) Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
3) Digital Communication, A. Bhattacharya, TMH Publishing Co.
4) J. Medhi,Stochastic Processes, 3rd Edition, New Age International, 2009.

**Course Outcome:** At the end of this course students will demonstrate the ability to

1. understand the concept of Stochastic Process in Communication System
2. represent various signals in different mathematical forms
3. analyze baseband transmission mode of digital data
4. analyze different career modulation techniques considering noise aspects