Course Code	Course Title	L	T	P	C
BECE306L	Digital Communication Systems	3	0	0	3
Pre-requisite	BECE206L, BECE206P	Syllabus version			
		1.0			

Course Objectives:

1. To understand the transmitter and receiver blocks of various waveform coding techniques.
2. To analyze various line coding techniques in time and frequency domains.
3. To identify the role of baseband, bandpass formats and information theory for effective transmission of signals, combat ISI and to increase the reliability of transmission.
4. To understand the principles and importance of spread spectrum and multiple access in the context of communication.

Course Outcomes:

Students will be able to

1. Comprehend the sampling and quantization process to recover the original signal
2. Analyse the performance of various waveform and Line coding techniques.
3. Design the various baseband pulses for ISI free transmission over finite bandwidth channels.
4. Examine the BER and bandwidth efficiency of the Bandpass modulation techniques.
5. Analyse the digital communication system with spread spectrum modulation.
6. Infer the elements of information theory.

Module:1	Sampling Process	4 hours

Block diagram of a digital communication system, bandwidth of signals. Sampling theorem - quadrature sampling of bandpass signals, Reconstruction of a message from its samples, Practical aspects of sampling and signal recovery.

Module:2	Waveform Coding Techniques	6 hours

Pulse Code Modulation (PCM) - Uniform quantization, Quantization noise, Signal-to-Noise Ratio, Robust quantization. Differential pulse code modulation (DPCM), Delta Modulation (DM) - Quantization noise in DM, Adaptive Delta Modulation.

Module:3	Line Codes	6 hours

Representation of line codes – Unipolar, Polar, Bipolar using NRZ and RZ, Manchester, Polar Quaternary codes, Differential encoding, Properties and applications of line codes – Power spectral density of line codes.

Module:4	Baseband System	5 hours

Baseband data transmission of binary data - Inter Symbol Interference (ISI), Nyquist criterion for zero ISI, Raised cosine filtering, correlative coding (duo binary and modified duo binary coding), eye pattern – Equalization.

Module:5	Bandpass system	12 hours

Gram-Schmidt Orthogonalization Procedure. Correlation and Matched filter receiver. Coherent modulation techniques - BASK, BPSK, BFSK, QPSK, MSK, Higher-order PSK and QAM, BER and Bandwidth efficiency analysis. Non-coherent modulation techniques – BASK, BFSK, DPSK.

Module:6	Spread Spectrum and Multiple Access Techniques	5 hours

Principles of spread spectrum - Generation of PN sequence and its properties, Direct Sequence Spread Spectrum (DSSS), Processing gain, Probability of error, Anti-jam characteristics, Frequency- Hop Spread Spectrum (FHSS). Multiple access techniques - TDMA, FDMA, CDMA, SDMA.

Module:7	**Introduction to Information Theory**	**5 hours**
Entropy, Mutual information and channel capacity theorem. Fundamentals of error correction - Hamming codes.		
Module:8	**Contemporary issues**	**2 hours**
	Total lecture hours:	**45 hours**

Text Book(s)	
1.	Simon Haykin, Digital Communications, 2017, 1st Edition, John Wiley, India.
Reference Books	
1.	John G. Proakis, Masoud Salehi, Digital Communication, 2018, 5th Edition (Indian edition), Mc Graw Hill Education, India.
2.	Bernard Sklar and Fredric J. Harris, Digital Communications: Fundamentals and Applications, 2020, 3rd Edition, Pearson , UK.
3.	B P Lathi, Zhi Ding, Modern Digital And Analog Communication Systems, 2017, 4th Edition, Oxford university Press, India.

Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test			
Recommended by Board of Studies	14-05-2022		
Approved by Academic Council	No. 66	Date	16-06-2022