3/4 B.Tech - SIXTH SEMESTER

EC6T4 Digital Communications Credits: 3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Prerequisites:
Signals and Systems, Analog Communications

Course Objectives:

- To study sampling, quantization and coding that are fundamental to digital transmission of analog signals.
- To understand baseband and band pass, spread spectrum signal transmission and reception techniques.
- To understand source coding techniques meant for data compression
- To understand error control coding techniques meant for error detection and correction.

Learning Outcomes:
Students are able to

- Design PCM and DM Systems.
- Analyse various methods of digital modulation and demodulation techniques.
- Analyse different Source Coding techniques and their efficiency.
- Generate Coding sequences for different error correcting codes

UNIT-I
Waveform Coding Techniques: Introduction, Pulse code modulation (PCM), Delta modulation, Adaptive delta modulation, Differential Pulse Code Modulation(DPCM), output Signal to quantization Noise ratio in PCM and DM systems.
Baseband Pulse Transmission: Intersymbol interference, Nyquist's Criterion for Distortionless Baseband Binary Transmission, Correlative coding.

UNIT-II
Signal Space Analysis: Introduction, Gram Schmidt Orthogonalization procedure, Geometric interpretation of signals, Coherent detection of signals in noise, Probability of error, Correlation receiver, Matched filter, Properties.
Digital Modulation Techniques: Coherent Phase Shift Keying, Coherent Frequency Shift Keying, Quadrature Phase Shift Keying, Non Coherent Frequency Shift Keying, Differential Phase Shift keying.

UNIT- III
Spread-Spectrum Modulation: Introduction, Pseudo-Noise Sequences, Direct sequence spread spectrum, Processing Gain, Probability of Error, Antijam Characteristics, Frequency-Hop Spread spectrum, Slow frequency Hopping, Fast Frequency Hopping

UNIT-IV

Information Theory: Introduction, information, Entropy, Source Coding Theorem, Data Compaction, ,Shannon-Fano coding, Huffman coding, Lempel-Ziv Coding, Discrete memoryless channels, Mutual information, channel coding Theorem, Differential Entropy , Information Capacity Theorem and its implications.

UNIT-V

Error Control Coding: Introduction, Linear Block codes, Syndrome and its Properties, Syndrome Decoding, Cyclic Codes, Encoder, Syndrome calculator, Convolutional Codes, Code Tree, Trellis and State Diagram.

Learning Resources

Text Books:

1. Digital communications, Simon Haykin, John Wiley, 4th Edition 2010
2. Digital Communications – John Proakis, TMH, 3rd Edition, 1995

References:

1. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 1979.
2. Communication systems –A B Carlson, McGraw-Hill, 4th Edition,2002
3. Principles of Communication Systems – H.Taub , D. Schilling , TMH, 3rd Edition,2008
4. Digital communications - B Sklar, Pearson Education, 2nd Edition, 2013

WEB REFERENCES:

1. http://www.ece.utah.edu/~npatwari/ece5520/lectureAll.pdf
2. http://nptel.iitm.ac.in/syllabus/syllabus.php?subjectId=117105077