ECE220: Principles of Communication

Programme: B. Tech. (ECE) Year: 2nd Semester: IV
Course : Core for CCE and ECE Credits: 3 Hours: 40

Course Context and Overview (100 words):

This course deals with the basic principles of analog communication techniques. The emphasis is on discussions of both linear and non-linear modulation techniques like amplitude modulation, frequency modulation, etc. In the first term (of about 14 hours) the analytical background needed for studying these methods is prepared. The second term and part of the third term is spent on discussions of the various modulation techniques. Performance evaluation and some applications are discussed in the remaining part of the semester.

Prerequisite Courses: None

Course Outcomes (COs):

On completion of this course, the students will have the ability to:
CO1: Apply basic mathematical tools and transformations like Fourier series, Fourier transforms, Hilbert transform, etc. in communication systems
CO2: Understand the working principles of different linear modulation techniques (AM and its different versions) and associated demodulators
CO3: Understand the working principles of different non-linear modulation techniques (FM and PM) and associated demodulators
CO4: Measure the performance of different modulation techniques in terms of power utilization, bandwidth requirement, complexity of modulator and demodulator circuits, etc.
CO5: Apply basic knowledge of Information theory for communication related problems

Course Topics:

Topics	Lecture Hours	
UNIT - I **1. Topic** Introduction and Mathematical Models	13	13
1.1 Introduction to Signals, Fourier series, Fourier transforms, power signal, energy signal, etc., Communication problem and system models	6	
1.2 Signal transmission through a linear system and Signal distortion over a communication channel	4	
1.3 Autocorrelation function, energy and power spectral density, Hilbert Transform, Persieval's Theorem	3	
UNIT - II **2. Topic** Linear Modulation Techniques	13	13
2.1 Representation of band-pass signals, concept of narrow band	2	

and wide band signals		
2.2 Analog modulation systems: Amplitude Modulation, Double side-band suppressed carrier (DSB-SC), Double side-band long carrier (DSB-LC), Single side-band (SSB), SSB+C, SSB-SC, Vestigial side-band (VSB), Quadrature amplitude modulation (QAM), etc.	6	
2.3 Modulators and demodulators for all the above techniques, coherent and non-coherent detection	4	
2.4 Pre-envelope, complex envelope, phasor diagram	1	
UNIT - III **3. Topic** Non-linear Modulation Techniques	8	8
3.1 Frequency Modulation and phase modulation, Demodulators for FM and PM, Direct and indirect method to generate FM and PM, Application of Phase locked loop and VCO in modulating and demodulating the signals	6	
3.2 Sampling of analog signals	1	
3.3 Frequency division multiplexing	1	
UNIT - IV **4. Topic** Performance evaluation of modulation techniques	6	6
4.1 Comparative performance of different modulation techniques	3	
4.2 Elements of Information theory	3	

Text Books:

1. Herbert Taub, Donald L. Schilling, and Gautam Saha, *Principles of Communication Systems*, McGraw Hill, New York, 4th Ed., 2013.
2. B. P. Lathi, *Modern Digital and Analog Communication Systems*, Oxford University Press, 3rd Ed.

Reference Books:

1. A. Bruce Carlson and Paul B. Crilly, *Communication Systems*, McGraw Hill, New York, 5th Ed., 2011.
2. Simon Haykin, *Communication Systems*, John Wiley Publications, 4th Ed.

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):

Evaluation Methods:

Item	Weightage (%)
Quiz 1	20
Quiz 2	
Quiz 3	
Mid-term Examination	30
End-term Examination	50